OPERATING INSTRUCTIONS

S300 Mini

Safety laser scanner

EN

SICK
Sensor Intelligence.

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1 About this document

Please read this chapter carefully before working with this documentation and the S300 Mini.

1.1 Function of this document

These operating instructions are designed to address *the technical personnel of the machine manufacturer or the machine operator* in regards to correct mounting, electrical installation, commissioning, operation and maintenance of the S300 Mini safety laser scanner.

These operating instructions do *not* provide instructions for operating the machine, the system or the vehicle on which the safety laser scanner is, or will be, integrated. Information on this is to be found in the appropriate operating instructions for the machine, the system or the vehicle.

1.2 Target group

These operating instructions are addressed to *planning engineers, machine designers and the operators* of machines and systems which are to be protected by one or several S300 Mini safety laser scanners. They also address people who integrate the S300 Mini into a machine, a system or a vehicle, initialize its use, or who are in charge of servicing and maintaining the device.

1.3 Scope

These operating instructions are original operating instructions.

These operating instructions are only applicable to the S300 Mini safety laser scanner with one of the following entries on the type label in the field *Operating Instructions*:

- 8014166 AE 0
- 8014166 AE W286
- 8014166 AE X175
- 8014166 AE XK34

This document is part of SICK part number 8014166 (operating instructions “S300 Mini Safety Laser Scanner” in all available languages).

For the configuration and diagnostics of these devices you require CDS (Configuration & Diagnostic Software) version 3.6.7 or higher. To determine the software version, select the **Module Info...** option in the **Help** menu.

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1.4 Depth of information

These operating instructions contain information on the S300 Mini safety laser scanner. They have the following parts:

- mounting
- electrical installation
- commissioning and configuration
- care and maintenance
- fault diagnosis and troubleshooting
- part numbers
- accessories
- conformity and approval

Planning and using protective devices such as the S300 Mini also require specific technical skills which are not detailed in this documentation.

General information on accident prevention using opto-electronic protective devices can be found in the competence brochure “Guidelines Safe Machinery”.

When operating the S300 Mini, the national, local and statutory rules and regulations must be observed.

Note Please refer also to the SICK AG homepage on the Internet at www.sick.com

Here you will find information on:

- application examples
- these operating instructions in different languages for viewing and printing

1.5 Abbreviations used

AGV Automated Guided Vehicle

ANSI American National Standards Institute

AWG American Wire Gauge = standardization and classification of wires and cables by type, diameter etc.

CDS SICK Configuration & Diagnostic Software = software for configuration and diagnostics on the S300 Mini

EDM External device monitoring

EFI Enhanced function interface = safe SICK device communication

EMC Electromagnetic compatibility

ESD Electrostatic discharge

ESPE Electro-sensitive protective equipment

FPLC Fail-safe programmable logic controller

OSSD Output signal switching device = signal output of the protective device that is used to stop the dangerous movement

RIA Robotic Industries Association

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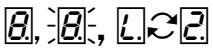
1.6 Symbols used

Recommendation Recommendations are designed to give you some assistance in your decision-making process with respect to a certain function or a technical measure.

Note Refer to notes for special features of the device.



Display indicators show the status of the 7-segment display on the S300 Mini:

- Constant indication of characters, e.g. 8
- Flashing indication of characters, e.g. 8
- Alternating indication of characters, e.g. L and 2

LED symbols describe the status of an LED:

- The “OSSDs in the OFF state” LED is illuminated continuously.
- The “Error/contamination” LED is flashing.
- The “Warning field interrupted” LED is off.

➢ Take action … Instructions for taking action are shown by an arrow. Read carefully and follow the instructions for action.

WARNING

Warning!

A warning indicates an actual or potential risk or health hazard. Observation and implementation of the warning will protect you from accidents.

Read carefully and follow the warning notices!

Information is displayed in the software indicating to you which settings you can make in the CDS (Configuration & Diagnostic Software).

The term “dangerous state”

The dangerous state (standard term) of the machine is always shown in the drawings and diagrams of this document as a movement of a machine part. In practical operation, there may be a number of different dangerous states:

- machine movements
- vehicle movements
- electrical conductors
- visible or invisible radiation
- a combination of several risks and hazards

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2 On safety

This chapter deals with your own safety and the safety of the system operators.

➢ Please read this chapter carefully before working with the S300 Mini or with the machine protected by the S300 Mini.

2.1 Qualified safety personnel

The S300 Mini safety laser scanner must be installed, connected, commissioned and serviced only by qualified safety personnel. Qualified safety personnel are defined as persons who

- due to their specialist training and experience have adequate knowledge of the power-driven equipment to be checked

and

- have been instructed by the responsible machine owner in the operation of the machine and the current valid safety guidelines

and

- are sufficiently familiar with the applicable official health and safety regulations, directives and generally recognized engineering practice (e.g. DIN standards, VDE stipulations, engineering regulations from other EC member states) that they can assess the work safety aspects of the power-driven equipment

and

- have access to these operating instructions and have read them.

As a rule these are qualified safety personnel from the ESPE manufacturer or also those persons who have been appropriately trained at the ESPE manufacturer, are primarily involved in checking ESPE and are allocated the task by the organization operating the ESPE.

2.2 Applications of the device

The S300 Mini safety laser scanner is used to protect persons and systems. It is intended to be used to monitor hazardous areas indoors.

It is not allowed to use the S300 Mini outdoors.

The S300 Mini cannot provide protection from parts thrown out of the machine or emitted radiation.

The S300 Mini complies with the requirements in the standard on the radiated emissions as defined for class A (industrial application); the S300 Mini is therefore only suitable for use in an industrial environment.

The device is a *type 3 ESPE* as defined by EN 61496-1 and CLC/TS 61496-3 and is therefore allowed for use with category 3 PL d controls as per EN ISO 13849-1 or SIL2 as per IEC 61508.

The S300 Mini is suitable for:

- hazardous area protection
- hazardous point protection
- access protection
- vehicle protection (electrically powered industrial trucks)

Note Depending on the application, other protective devices and measures may be required in addition to the safety laser scanner.

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2.3 Correct use

The S300 Mini safety laser scanner must be used only as defined in section 2.2 “Applications of the device” on page 10. It must be used only by qualified personnel and only on the machine where it has been installed and initialized by qualified safety personnel in accordance with these operating instructions. It is only permitted to be used on machines on which the dangerous state can be stopped immediately by the S300 Mini and/or it is possible to prevent the machine being placed in operation.

Note If the device is used for any other purposes or modified in any way — also during mounting and installation — any warranty claim against SICK AG shall become void.

2.4 General safety notes and protective measures

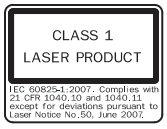
WARNING

Pay attention to the safety notes!

Please observe the following items in order to ensure the correct use of the S300 Mini safety laser scanner.

Repair only by authorized persons!

The improper repair of the protective device can result in the loss of the protective function. The protective device is only allowed to be repaired by the manufacturer or persons authorized by the manufacturer.


CLASS 1
LASER PRODUCT
IEC 60825-1:2007. Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, June 2007.

The S300 Mini safety laser scanner is of laser safety class 1. Additional measures for screening the laser radiation are not necessary (eye safe).

- This device meets the norms: IEC 60 825-1 as well as CDRH 21 CFR 1040.10 and 1040.11; excluded are deviations due to Laser Notice No. 50, dated 24.06.2007. In the standards CDRH 21 CFR 1040.10 and 1040.11 the following note is required: “Caution — use of controls, adjustments or performance of procedures other than those herein specified may result in hazardous radiation exposure!”
- During the mounting, installation and usage of the S300 Mini, observe the standards and directives applicable in your country. You will find an overview of the most important regulations in section 2.6 “Applicable directives and standards” on page 14.
- The national/international rules and regulations apply to the installation, commissioning, use and periodic technical inspections of the S300 Mini safety laser scanner, in particular:
  - Machinery Directive 2006/42/EC
  - Work Equipment Directive 2009/104/EC
  - the work safety regulations/safety rules
  - other relevant health and safety regulations
- Manufacturers and operators of the machine on which the S300 Mini is used are responsible for obtaining and observing all applicable safety regulations and rules.

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- The notes, in particular the test notes (see chapter 9 “Commissioning” on page 92) in these operating instructions (e.g. on use, mounting, installation or integration into the machine control) must be observed.
- Changes to the configuration of the devices can degrade the protective function. After every change to the configuration you must therefore check the effectiveness of the protective device. The person who makes the change is also responsible for the correct protective function of the device. When making configuration changes, please always use the password hierarchy provided by SICK to ensure that only authorized persons make changes to the configuration. The SICK service team is available to provide assistance if required.
- The tests must be carried out by qualified safety personnel or specially qualified and authorized personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- The operating instructions must be made available to the operator of the machine where the S300 Mini is used. The machine operator is to be instructed in the use of the device by qualified safety personnel and must be instructed to read the operating instructions.
- To meet the requirements of the relevant product standards (e.g. EN 61496-1), the external voltage supply for the devices must be able to bridge a brief mains failure of 20 ms. Power supplies according to EN 60204-1 satisfy this requirement. Suitable power supplies are available as accessories from SICK (see section 13.3 “Accessories/spare parts” on page 123).

➢ Enclosed with these operating instructions is a checklist for checking by the manufacturer and OEM (see section 14.2 “Checklist for the manufacturer” on page 126). Use this checklist when checking the system that is protected with the S300 Mini.

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2.5 Environmental protection

The S300 Mini safety laser scanner is constructed in such a way that it adversely affects the environment as little as possible and uses only a minimum of power and natural resources.

➢ At work, always act in an environmentally responsible manner.

2.5.1 Disposal

Unusable or irreparable devices should always be disposed as per the applicable national regulations on waste disposal (e.g. European waste code 16 02 14).

Notes

- We would be pleased to be of assistance to you on the disposal of these devices. Contact your local SICK representative.
- Information on the individual materials in the S300 Mini is given in chapter 12 “Technical specifications” on page 110.

2.5.2 Separation of materials

WARNING

Only qualified safety personnel are allowed to separate materials!

Caution is required when dismantling devices. There is a risk of injuries.

Before you send the devices for appropriate recycling, it is necessary to separate the different materials in the S300 Mini.

➢ Separate the housing from the rest of the parts (in particular the circuit boards).

➢ Send the separated parts for recycling as appropriate (see Tab. 1).

Tab. 1: Overview on disposal by components

Components	Disposal
Product	
Housing	Metal recycling (aluminium)
Motor bracket	Metal recycling (zinc die-cast housing)
Optics cover	Plastic recycling
Circuit boards, cables, connectors and electrical connecting pieces	Electronic recycling
Packaging	
Cardboard, paper	Paper/cardboard recycling
Polyethylene packaging	Plastic recycling

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2.6 Applicable directives and standards

The most important directives and standards, valid for the use of opto-electronic protective devices in Europe, are listed below. Further regulations may be of importance to you, depending on the application. You can obtain further information of machine-specific standards from national institutions (e.g. DIN, BSI, AFNOR etc.), the authorities or your trade association.

If you operate the machine or vehicle in a country outside the European Union, please contact the manufacturer of the system and the local authorities and obtain information on the regulations and standards applicable there.

Application and installation of protective devices

Machinery Directive 2006/42/EC, e.g.:

- Safety of machinery — Basic concepts, general principles for design (EN ISO 12 100)
- Industrial automation systems — Safety of integrated manufacturing systems — Basic requirements (ISO 11 161)
- Safety of machinery — Electrical equipment of machines — Part 1: General requirements (EN 60 204-1)
- Safety of machinery — safety distances to prevent hazard zones being reached by the upper and lower limbs (EN ISO 13 857)
- Safety requirements for robots (EN ISO 10 218-1)
- Safety of industrial trucks. Driverless trucks and their systems (EN 1525)
- Safety of machinery — The positioning of protective equipment in respect of approach speeds of parts of the human body (EN ISO 13 855)
- Safety of machinery — Principles for risk assessment (EN ISO 14 121-1)
- Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (EN ISO 13 849-1) as well as part 2: Validation (EN ISO 13 849-2)
- Safety of machinery — electro-sensitive protective equipment — Part 1: General requirements (EN 61 496-1) as well as part 3: Special requirements for AOPDDR (CLC/TS 61 496-3)
- Safety of machinery — Application of protective equipment to detect the presence of persons (IEC/TS 62 046)

Foreign standards, for example:

- Performance Criteria for Safeguarding (ANSI B11.19)
- Machine tools for manufacturing systems/cells (ANSI B11.20)
- Safety requirements for Industrial Robots and Robot Systems (ANSI/RIA R15.06)
- Safety Standard for guided industrial vehicles and automated functions of named industrial vehicles (ANSI B56.5)

Note To some extent these standards require the protective device to have the safety level **Control reliable**. The S300 Mini safety laser scanner meets this requirement.

Recommendation Please request our competence brochure “Guidelines Safe Machinery” on this subject (part no. 8007988).

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3 Product description

This chapter provides information on the special features and properties of the S300 Mini safety laser scanner. It describes the construction and the operating principle of the device.

3.1 Special features

- small design
- 270° scan area
- increased dust and particle tolerance due to dazzle and particle algorithms
- variants with scanning ranges up to 1 m[1)], 2 m or 3 m (maximum protective field radii)
- configuration using PC or notebook with SICK Configuration & Diagnostic Software
- field sets comprising of one protective field and up to two warning fields
- contour monitoring of the protective field if only one warning field is used

S300 Mini Standard

- only standalone operation
- 1 field set
- 1 monitoring case
- integrated external device monitoring (EDM)
- integrated restart interlock/restart interlock delay for which the parameters can be set
- 2 universal I/O connections

S300 Mini Remote

- Only in combination with safety controller, safety laser scanner or gateway. The following functions can only be configured/installed on the upper level device:
  - stopping of the dangerous movement of a machine, system or vehicle
  - restart interlock
  - EDM
- safe bus interface via enhanced function interface (EFI) for operation in a system with other safety laser scanners, with products of the sens:Control product group or with a Flexi Soft safety controller
- up to 16 field sets
- up to 32 monitoring cases

[1)] S300 Mini Standard only.

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3.2 Function

The S300 Mini safety laser scanner operates correctly as a protective device only if the following conditions are met:

- The control of the machine, system or vehicle must be electrical.
- It must be possible to transfer the dangerous machine, system or vehicle state to a safe state using the OSSDs on the S300 Mini Standard at any time, i.e. before a person has reached the hazardous point or hazardous area.

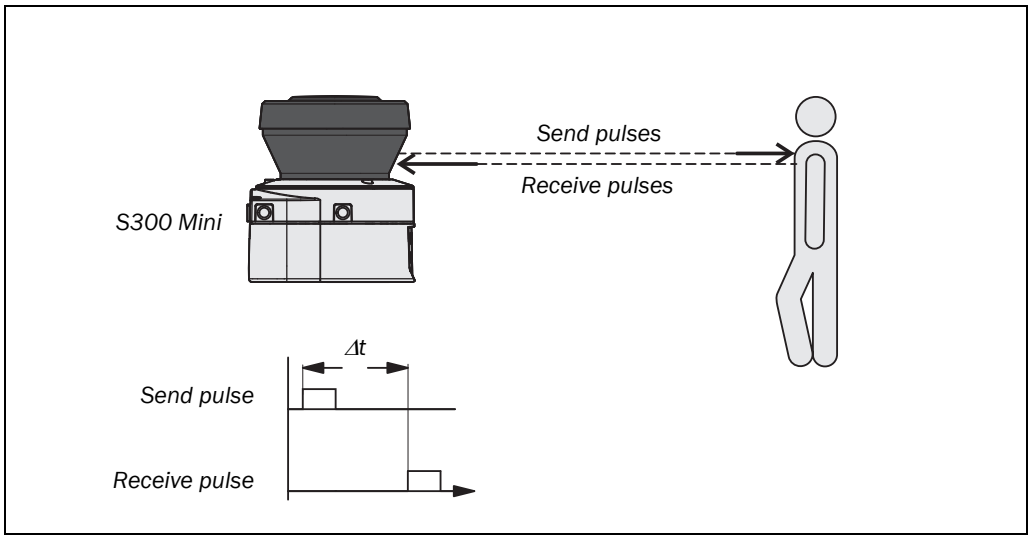
  Or:

  It must be possible transfer the dangerous state of the machine, the system or the vehicle to a safe state at any time using the OSSDs on a safety controller connected to the S300 Mini Remote or a further safety laser scanner,
- The S300 Mini must be mounted and configured such that it detects objects as they enter the hazardous area (see chapter 5 “Mounting” on page 54 and chapter 9 “Commissioning” on page 92).
- The safety laser scanner’s optical path must always remain clear and is not allowed to be covered by transparent objects such as protective windows, Plexiglas, lenses etc. The safety laser scanner’s protective function can only be ensured if the contamination measurement function is not bypassed by such measures.

3.2.1 Principle of operation

The S300 Mini is an optical sensor that scans its surroundings in two dimensions using infrared laser beams. It is used to monitor hazardous areas on machines or vehicles.

Fig. 1: Principle of operation, time-of-flight measurement by the S300 Mini



The S300 Mini works on the principle of time-of-flight measurement. It sends out very short pulses of light (send pulses). At the same time an “electronic stopwatch” is started. When the light hits an object, it is reflected and received by the safety laser scanner (receive pulses). From the time between sending and reception (Δt) the S300 Mini calculates the distance to the object.

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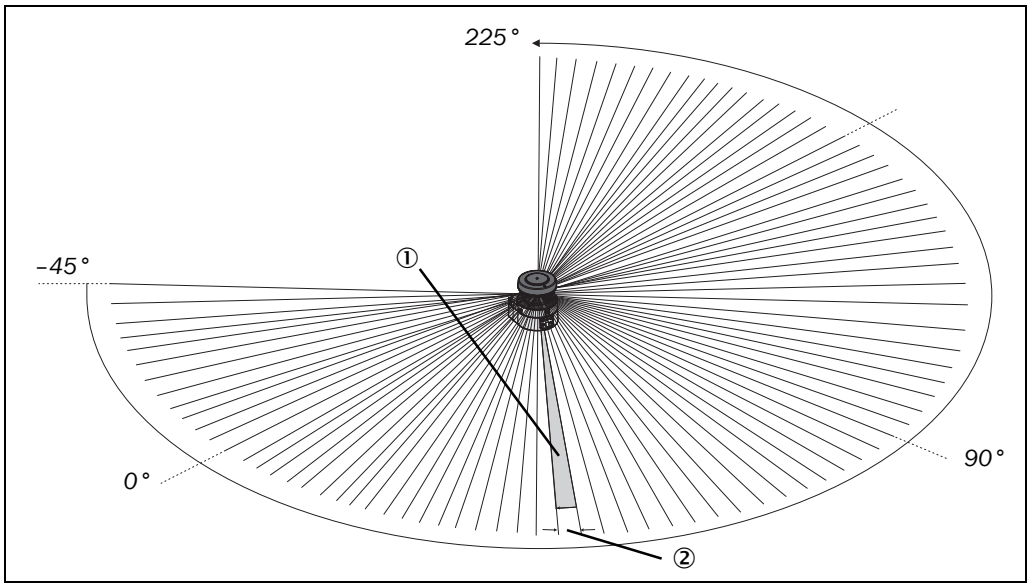
Fig. 2: Principle of operation, rotation of the S300 Mini



In the S300 Mini there is also a mirror rotating at constant speed that deflects the light pulses such that they cover an arc of 270°. In this way an object can be detected in the protective field within 270°. The first beam of a scan starts at –45° relative to the back of the safety laser scanner.

The S300 Mini sends a pulse of light with an angular resolution of 0.5° ①. As a result resolutions between 30 mm and 150 mm can be achieved ②.

Due to its active scanning principle, the S300 Mini does not require receivers or reflectors. This has the following advantages:

- Your installation effort is lower.
- You can easily adapt the monitored area to the hazardous area on a machine.
- In comparison with contact sensors, electro-sensitive scanning is nearly wear-free.

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3.2.2 Field set comprising of protective field and warning field(s)

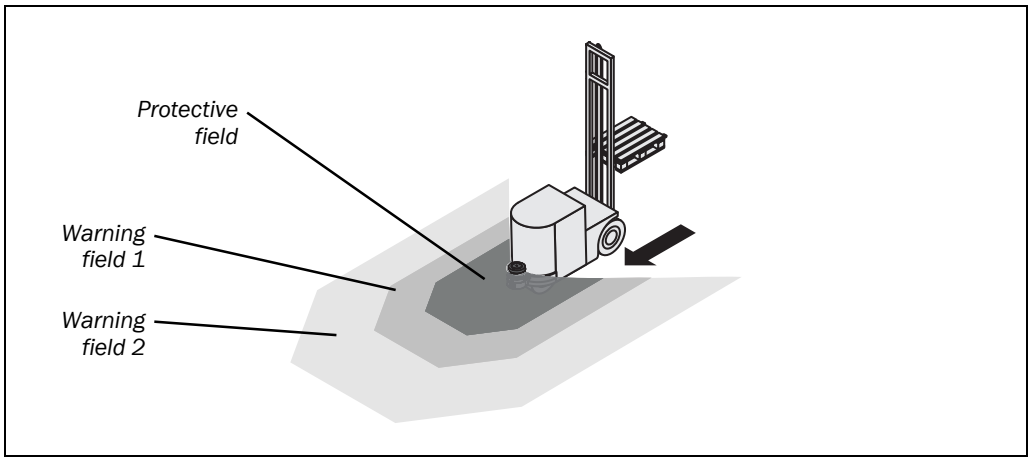
Protective fields and warning fields form the so-called field set. You can configure these field sets with the aid of the CDS. The fields can be configured as circular, rectangular or of arbitrary shape. If the area to be monitored changes, then you can re-configure the S300 Mini in software without additional mounting effort.

Depending on the variant used (see section 3.3 “S300 Minivariants” on page 19), you can define up to 16 field sets and save these in the safety laser scanner. In this way you can switch to a different field set in case of a change in the monitoring situation (see section 3.2.3 “Monitoring cases of the S300 Mini Remote” on page 19).

You can configure field sets comprising one protective field and one or two warning fields.

The S300 Mini secures the hazardous area on a machine or vehicle. As soon as the safety laser scanner detects an object in the protective field, it switches the OSSDs to the OFF state and thus initiates the shutdown of the machine or stop of the vehicle.

Fig. 3: Field set with one protective field and two warning fields



You can define the warning fields such that the safety laser scanner detects an object before the actual hazardous area.

Warning field 1 can be used in particular for vehicle protection to detect an object even before the actual hazardous area and to slowly retard the movement of the vehicle or bring it to a standstill. In this way the wear on the brakes on an AGV can be reduced. Warning field 2 can also be used to trigger a warning signal.

Note A **warning field** on all S300 Mini variants is **not** allowed to be used for tasks related to the protection of people.

Contour monitoring

In addition to the protective field, the S300 Mini can also monitor a contour (e.g. the floor in vertical applications).

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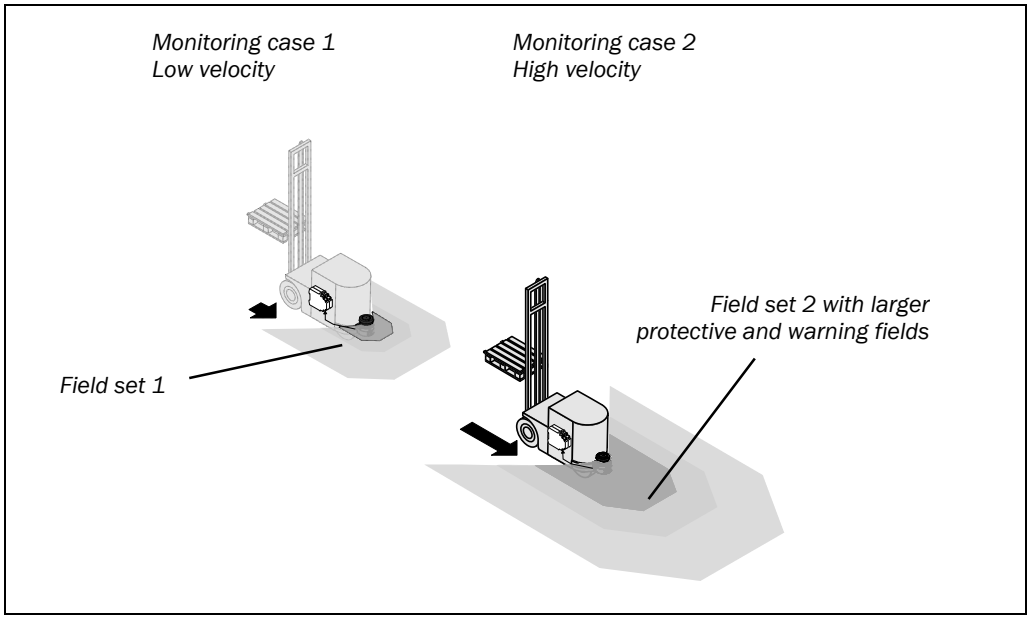
3.2.3 Monitoring cases of the S300 Mini Remote

On the S300 Mini Remote up to 32 monitoring cases can be defined and selected via EFI during operation. In this way process-dependent hazardous area protection or velocity-dependent vehicle monitoring is possible for example.

Fig. 4: S300 Mini Remote with two monitoring cases on an AGV



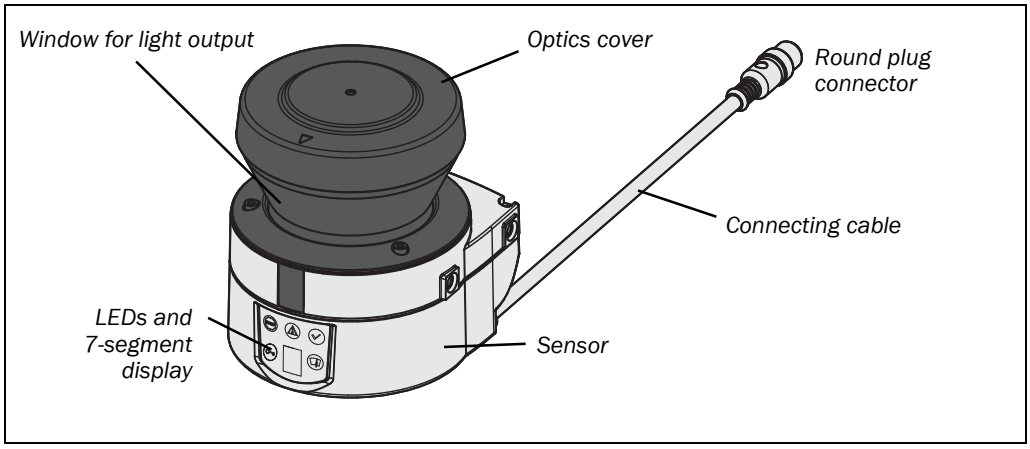
3.3 S300 Minivariants

3.3.1 Device components

The S300 Mini safety laser scanner comprises three components:

- the sensor with the opto-electronic detection system, the LEDs, the 7-segment display and the connecting cable with the electrical connections
- the optics cover with the window for the light output
- the connecting cable with round plug connector (the round plug connector contains all electrical connections with the exception of the configuration interface)

Fig. 5: Device components



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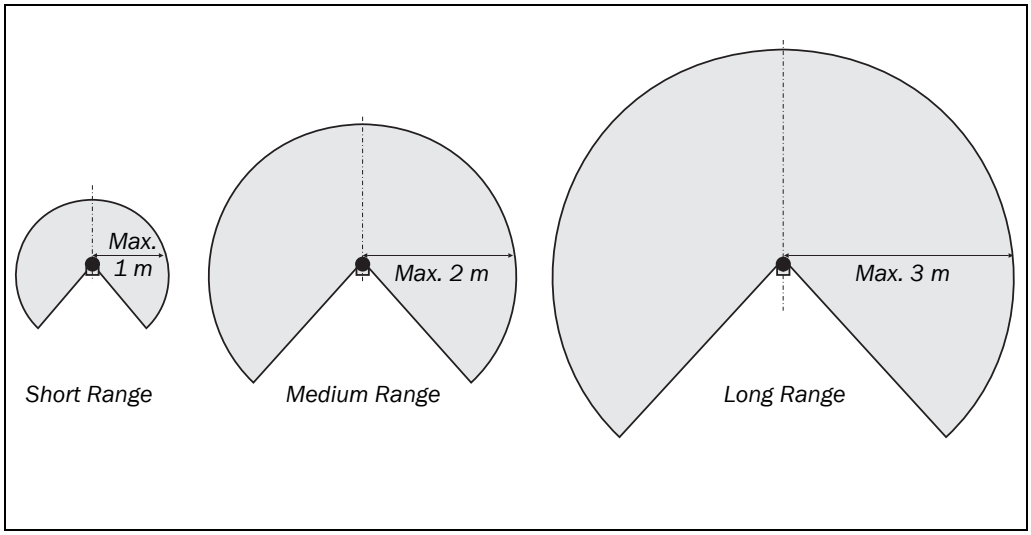
3.3.2 Functions of the S300 Mini variants

So that different applications can be covered, two S300 Mini variants each with two or three different scanning ranges are available.

Scanning ranges

The S300 Mini variants differ in the maximum scanning range and the resulting size of the protective field.

Fig. 6: Protective field ranges



Variants

Tab. 2: Functions of the S300 Mini variants

Functions	Standard	Remote
Protective field range, radial [m]	1, 2, 3	2, 3
Warning field range, radial[2] [m]	8	8
Object resolution [mm]	30, 40, 50, 70, 150[3]	30, 40, 50, 70, 150[3]
Pairs of output signal switching devices (OSSDs)	1	–
External device monitoring (EDM)	■[4]	–
Universal I/Os	2	–
Restart interlock/delay	■[4]	–
Field sets comprising of one protective field and two warning fields	1	16
Monitoring cases	1	32
Output for warning field interruption	■	–
EFI interface (safe SICK device communication)	–	■
Park mode, activation via monitoring case	–	■
Stand-by, activation via EFI bit or stand-by input	■[4]	■

[2] Warning field range with a remission of 30 % (see section 12.1 on page 105).
[3] 150 mm resolution can only be configured with the Long Range variant with 3 m scanning range.
[4] Availability depending on the configuration of the universal I/Os (see section 4.4 on page 35).

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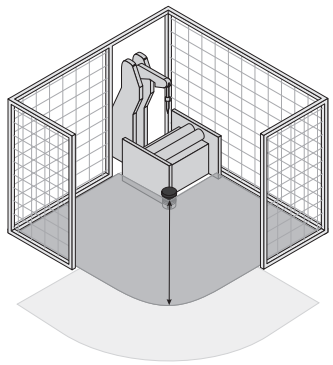
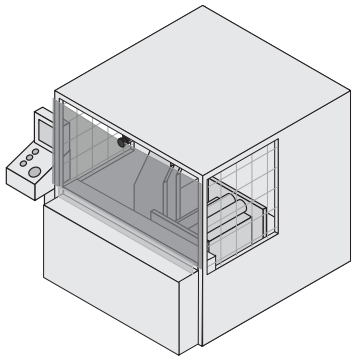
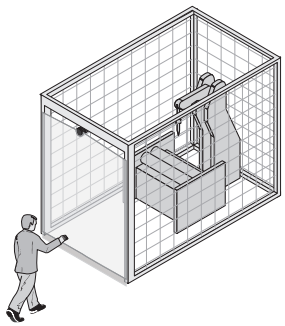
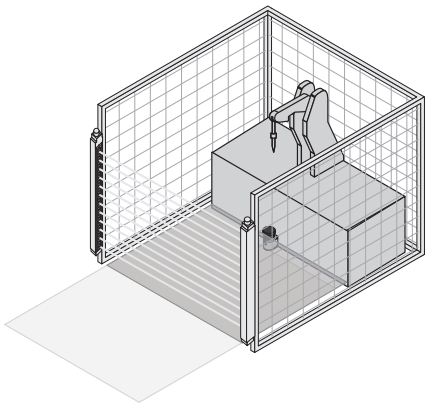
3.3.3 Applications

Tab. 3: Possible applications for the S300 Mini variants

S300 Mini Standard: Hazardous area protection on an insertion station	
S300 Mini Standard: Hazardous point protection on an insertion station	
S300 Mini Standard Long Range: Access protection for high areas of access	
S300 Mini Standard: Presence detection for a safety light curtain	

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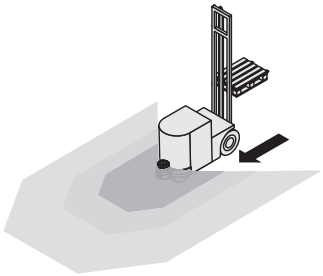
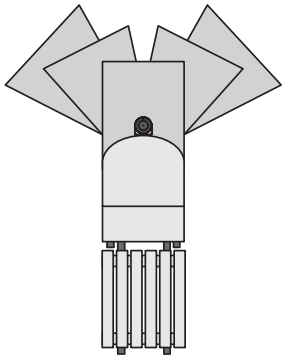
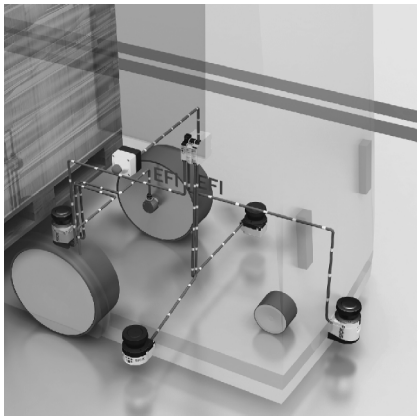
S300 Mini Standard: Protection of an automated guided vehicle (AGV) for one velocity	
S300 Mini Remote in combination with a Flexi Soft safety controller: Protection of an automated guided vehicle (AGV) with protective fields for different vehicle velocities and driving around bends	
S300 Mini Remote, S300 Expert, in combination with a Flexi Soft safety controller: Velocity-dependent protection of an automated guided vehicle (AGV). An S300 Expert measures the velocity and provides the velocity information to the other safety laser scanners via EFI.	

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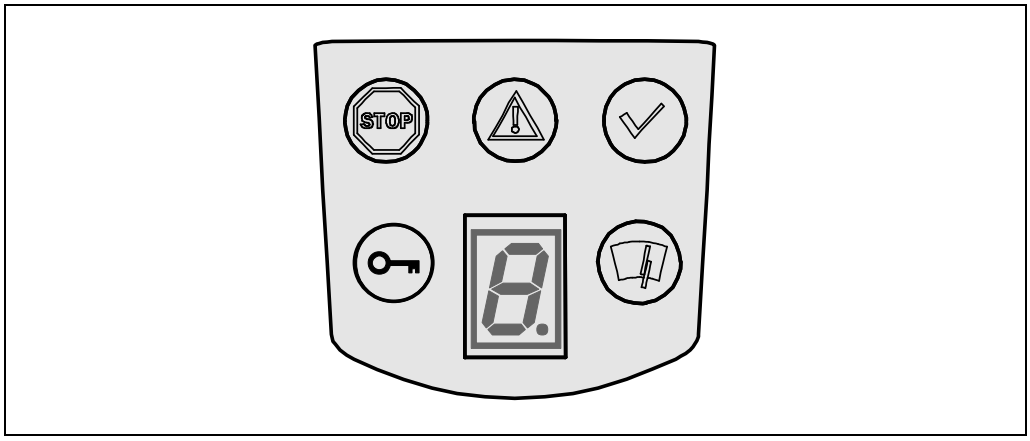
3.4 Status indicators

3.4.1 LEDs and 7-segment display

The LEDs and the 7-segment display indicate the operational status of the S300 Mini. They are on the front face of the safety laser scanner.

Fig. 7: Status indicators on the S300 Mini



The symbols have the following meaning:

Tab. 4: Status indicators on the S300 Mini

Symbol	S300 Mini Standard	S300 Mini Remote
	OSSDs in the OFF state (e.g. in case of object in the protective field, monitored contour changed, reset required, lock-out)	Error. **Due to the standards' situation, is not used for OSSDs in the OFF state (S300 Mini Remote does not have OSSDs).**
	Warning field interrupted (object in one of the warning fields)	
	OSSDs in the ON state (no object in protective field)	Device in operation. **LED illuminates even with protective field infringed due to the standards' situation!**
	Reset required	Not used
	Optics cover contaminated	
	7-segment display for the indication of the status and errors	

Note You will find detailed information in section 11.3 "Error and status indications on the LEDs" on page 98 and in section 11.4 "Error and status indications on the 7-segment display" on page 99.

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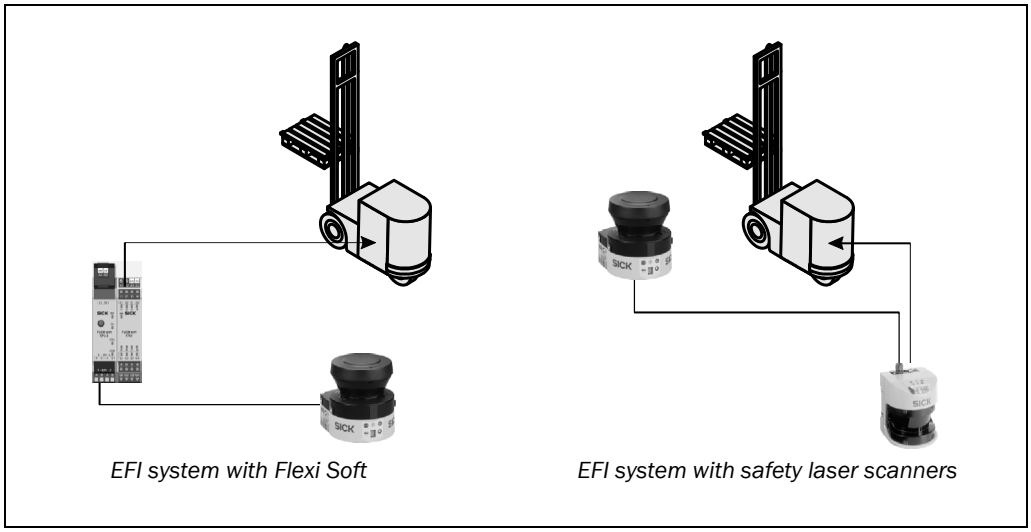
3.5 Interoperability

The S300 Mini Remote can **not be used as a standalone device**. It is connected to an EFI group via EFI. An EFI system can comprise two safety laser scanners, a sens:Control device with one to two safety laser scanners or a Flexi Soft safety controller with up to four safety laser scanners.

Fig. 8: S300 Mini Remote in combination with a Flexi Soft safety controller or an S3000



EFI system with Flexi Soft *EFI system with safety laser scanners*

Note Functions such as restart interlock or EDM, and in particular the shutdown of the dangerous movement of a machine, a system or a vehicle, must be implemented using the safety controller or using the other safety laser scanner.

Addressing of the guest

If two safety laser scanners are operated on an EFI string, then one is the host, the other the guest. If only one safety laser scanner is operated on an EFI string, then this device is the host.

All devices involved can be unambiguously identified by the address and information can be distributed and retrieved using bit assignment (see also Technical Description “EFI — Enhanced Function Interface”, SICK part no. 8012621).

WARNING

In an EFI system with two safety laser scanners, set the address of one of the scanners to guest!

To be able to unambiguously identify a S300 Mini in a system, you must set its address to host or guest. For this purpose pin 1 is connected to 0 V or 24 V DC (see Tab. 20 on page 81).

➢ On the **host** connect pin 1 (H/G) **to 0 V DC**.

➢ On the **guest** connect pin 1 (H/G) **to 24 V DC**.

When the S300 Mini is switched on in an EFI system, the following message appears briefly on the 7-segment display:

- H on the S300 Mini host
- G on the S300 Mini guest

Note In an EFI system with an S3000 or S300 the S300 Mini must be configured as a guest, it is never allowed to be configured as host.

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3.5.1 Examples for EFI systems

Fig. 9: EFI system with Flexi Soft safety controller

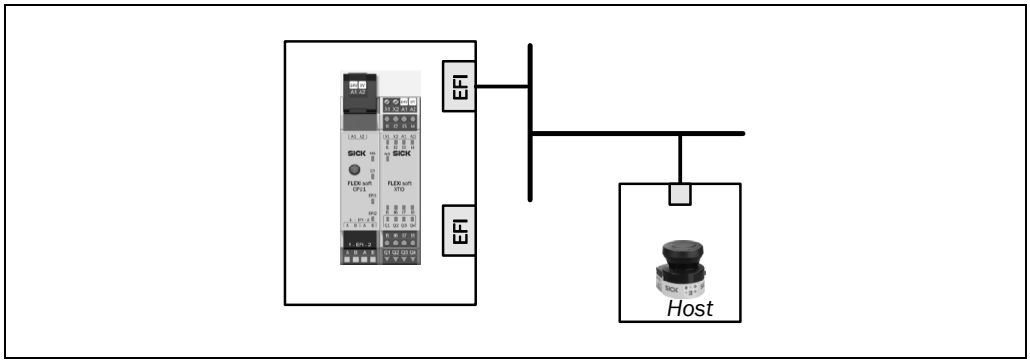


Fig. 10: EFI system with S3000

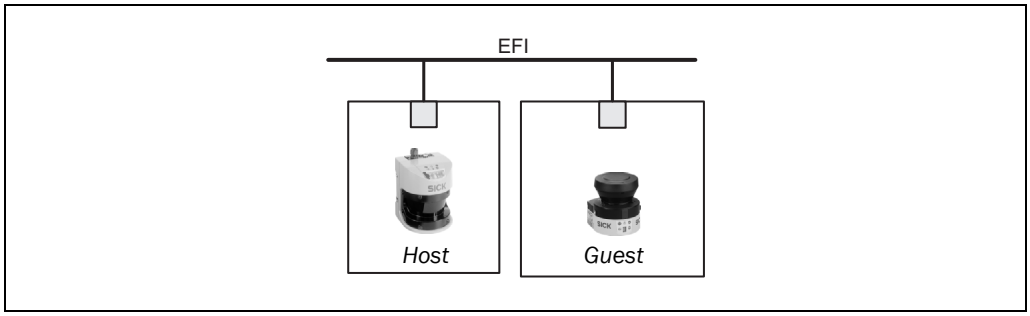


Fig. 11: EFI system with sens:Control device

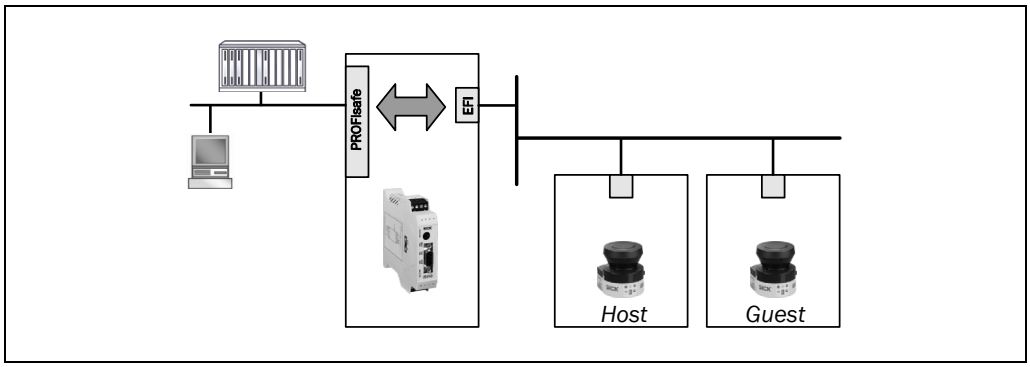
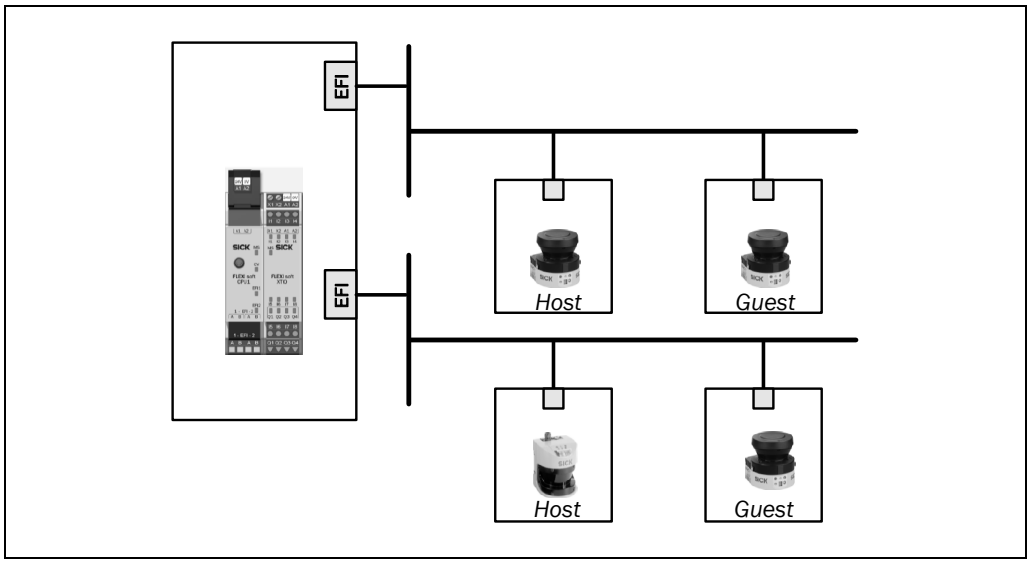


Fig. 12: EFI system with Flexi Soft safety controller and four safety laser scanners



Four safety laser scanners in combination with a Flexi Soft safety controller: in the EFI string at the top in the example, the address of one S300 Mini is set to host, the other as the guest. In the EFI string at the bottom the address of the S3000 **must** be set to host, the S300 Mini to guest.

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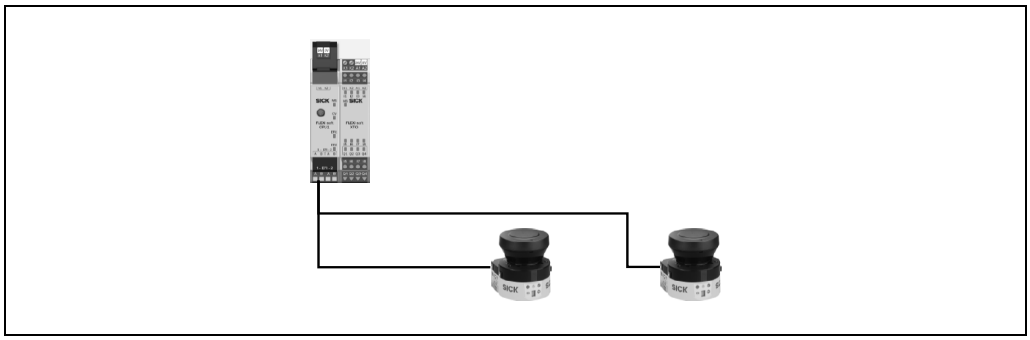
To connect two safety laser scanners to one of the EFI strings on a Flexi Soft safety controller, wire them radially, as shown in Fig. 13.

Fig. 13: EFI network topologies



You will find detailed examples on the connection of safety laser scanners to a safety controller in Fig. 67 on page 88 and Fig. 68 on page 89.

3.5.2 Interoperability of the variants

The different variants of the S300 Mini can work together as host or guest with other variants or different safety laser scanner families in an EFI system. The following tables show which devices can form a system.

Interoperability with safety laser scanners

	S3000 Standard	S3000 Advanced	S3000 Professional	S3000 Remote	S3000 Expert	S300 Standard	S300 Advanced	S300 Professional	S300 Expert	S300 Mini Standard	S300 Mini Remote
S300 Mini Standard	X	X	X	X	X	X	X	X	X	X	X
S300 Mini Remote	■	■	■	■ [5)]	■	■	■	■	■	X	■ [5)]

Tab. 5: Interoperability of the variants
■ = *EFI system possible*
X = *EFI system not possible*

Interoperability with safety laser scanners in compatibility mode

The S300 Mini cannot form an EFI system with an S3000 or S300 that is operated in the compatibility mode, (for details on the compatibility mode in the S3000 and S300 safety laser scanners see their operating instructions. You will find the latest operating instructions in the Internet at www.sick.com).

[5)] Only in combination with Flexi Soft safety controller or sens:Control device.

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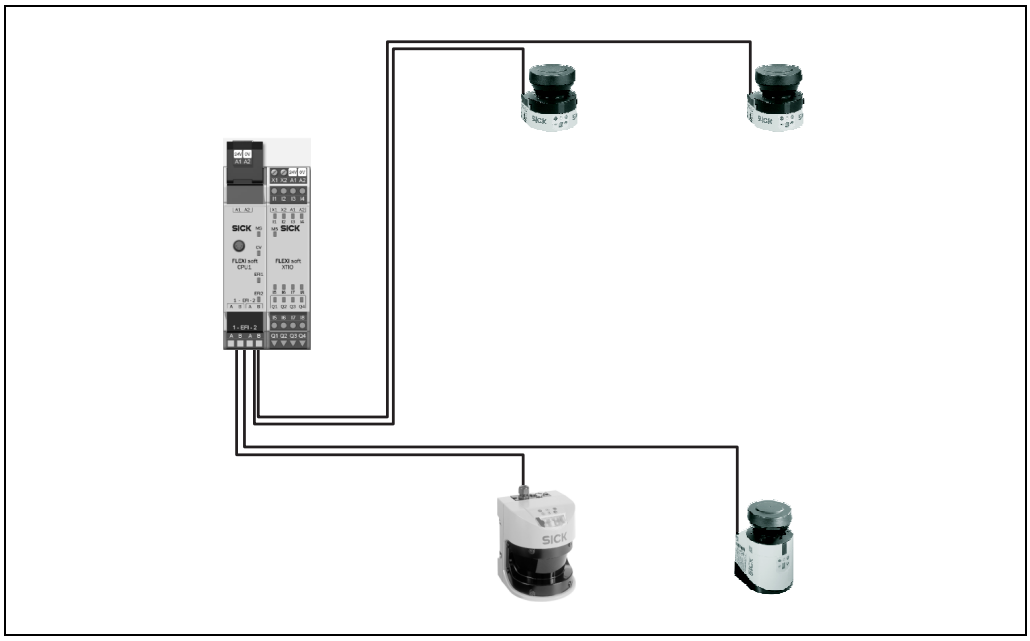
3.5.3 S300 Mini Remote in combination with a Flexi Soft safety controller

The Flexi Soft safety controller provides two EFI strings; up to two safety laser scanners (S3000, S300, S300 Mini) can be connected to each of these strings. It is therefore possible to realize applications with up to four safety laser scanners (see also section 7.2.2 on page 85 and section 7.3.6 on page 89).

Fig. 14: S300 Mini, S300 and S3000 in combination with a Flexi Soft safety controller



The status of the protective and warning fields is transmitted using EFI and can be combined in the Flexi Soft safety controller as required. During this process it does not matter whether the devices are connected using one or various EFI strings. The signal of the safety outputs on the Flexi Soft safety controller is transferred, e.g., to a machine or vehicle control.

The monitoring cases that have been configured in the safety laser scanners can be switched with the aid of the programmed logic blocks in the Flexi Soft safety controller.

If, e.g. incremental encoders are used for the velocity measurement, then these can be connected e.g. to an S3000 Expert. The velocity signals are distributed to all safety laser scanners via EFI.

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To configure and perform diagnostics on the S300 Mini Remote connect the PC to the configuration connection on the Flexi Soft safety controller, the related EFI partner device, or directly to the S300 Mini Remote.

Fig. 15: Configuration example in the Flexi Soft Designer

3.5.4 Automatic Configuration Recovery (ACR)

ACR is a function of the Flexi Soft main module. With the aid of this function it is possible to save the configuration of the devices connected via EFI. With the ACR function activated, the existing configuration is automatically transferred to the newly connected scanner in the event of device replacement.

Note To use the ACR function, a **replacement device of the same type** (same type code) is required.

Prerequisites for the usage of the ACR function

- Flexi Soft main module FX3-CPU2 or higher
- Flexi Soft Designer V1.5.0 or higher
- Configuration and Diagnostic Software (CDS) V3.6.8 or higher

Notes

- It is only possible to change the scanner configuration with ACR deactivated.
- If a configuration prepared with the aid of the ACR function is detected, a warning is displayed in CDS. In this case the ACR function on this EFI string must be deactivated in Flexi Soft Designer so that the configuration can be changed.
- This warning also appears if a device with ACR previously activated is to be used in a new situation or is to be re-configured.

WARNING

Check the safety function of the devices!

If the ACR function is activated, it will automatically overwrite the configuration of the scanner with the configuration saved in the Flexi Soft main module.

➢ After setting up the ACR function and after replacing a scanner, check the safety function of the devices (see chapter 9 “Commissioning” on page 92).

You will find further details on ACR in the operating instructions Flexi Soft Hardware (SICK part no. 8012478) and Flexi Soft Software (SICK part no. 8012480).

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3.5.5 Interoperability with sens:Control devices

The S300 Mini Remote safety laser scanner can be connected to the following sens:Control devices and via these devices integrated into the related bus system.

- PROFIsafe gateway UE4140-22I0000
- PROFIBUS gateway UE1140-22I0000
- Ethernet gateway UE1840-22H0000
- CANopen gateway UE1940-22I0000
- PROFINET IO gateway UE4740-20H0000

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4 Configurable functions

4.1 System parameters

A name can be assigned to the application configured as well as to the safety laser scanner(s). The names are saved in the devices after the configuration is transferred. The name chosen may be, for example, the identifier for the vehicle, system or the machine.

You enter the application name and the names of the safety laser scanners used in the CDS.

4.1.1 Application name

Enter a name for your application. You can enter a name with a maximum of 16 characters.

If you assign unique application names, you may “reserve” the devices for certain duties. A machine maintenance person comparing exchanged devices with the configuration data saved in the CDS will be notified that the application name does not match. He may then exchange these devices for those with the correct application name.

4.1.2 Name of the scanner

Enter a **device name** for each of the safety laser scanners in the system. You can enter names with a maximum of 8 characters.

Recommendation Use meaningful names, e.g. “front” and “rear” for vehicle monitoring. Unique device names make the subsequent configuration steps easier (for example on allocating the control inputs or the OSSDs).

On a host/guest system with two safety laser scanners, the device names must always be different.

4.1.3 User data

You can enter your name in the field **Name of the user**. You can enter a name with a maximum of 22 characters. This is then added to the configuration protocol and in the diagnostics report.

4.1.4 Display direction of the 7-segment display

The depiction of numbers on the 7-segment display can be rotated by 180° with the aid of the CDS. This is useful, for example, when the S300 Mini must be rotated by 180° owing to the specific assembly.

If you rotate the numbers of the 7-segment display, the point in the 7-segment display goes out.

How to determine the display direction of the 7-segment display:

- Under **7-segment display**, activate the **Rotated by 180°** option. After the configuration draft has been transferred to the S300 Mini, the numbers of the 7-segment display are rotated by 180°.

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4.2 Application

With the help of the CDS you can configure the S300 Mini for the required application. Depending on whether you select a stationary or a mobile application, different configuration options are available:

Tab. 6: Comparison of mobile and stationary applications

Mobile applications	Stationary applications
Resolution	
• 30 mm (hand detection with smaller protective field size) • 40 mm (hand detection with larger protective field size) • 50 mm (leg detection with smaller protective field size) • 70 mm (leg detection with larger protective field size)[6]	• 30 mm (hand detection with smaller protective field size) • 40 mm (hand detection with larger protective field size) • 50 mm (leg detection with smaller protective field size) • 70 mm (leg detection with larger protective field size) • 150 mm[7] (body detection)
Manipulation prevention	
The safety laser scanner checks whether in any 90° segment all measured values correspond to the maximum distance value that can be measured.	
• If this is the case, the S300 Mini shuts down after **2 hours** and signals .	• If this the case, the S300 Mini shuts down after **5 seconds** and signals .

[6] In mobile applications a resolution of only 70 mm is required for leg detection, as a coarser resolution is adequate for the detection of a human leg due to the movement of the vehicle.

[7] Can only be configured with the Long Range variant with 3 m scanning range.

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4.2.1 Resolution

The maximum protective field range[8] depends on the configured resolution. The following table shows the related maximum protective field range of the three variants at the resolutions that can be set:

Tab. 7: Maximum protective field range at different resolutions

	Maximum protective field range
Short Range variant	
30 mm (hand detection)	1.00 m
40 mm (hand detection)	1.00 m
50 mm (leg detection)	1.00 m
70 mm (leg detection)	1.00 m
Medium Range variant	
30 mm (hand detection)	1.25 m
40 mm (hand detection)	1.60 m
50 mm (leg detection)	2.00 m
70 mm (leg detection)	2.00 m
Long Range variant	
30 mm (hand detection)	1.25 m
40 mm (hand detection)	1.60 m
50 mm (leg detection)	2.10 m
70 mm (leg detection)	3.00 m
150 mm (body detection)	3.00 m

Note The warning field can be configured to up to 8 m for all variants and resolutions. The detection capability within the warning field is dependent on the remission of the objects to be detected (see section 12.1 on page 105).

4.2.2 Basic response time

The basic response time of the S300 Mini is 80 ms.

Note You may need to add supplements to the basic response time due to multiple sampling and data transmission over EFI (see section 12.2 “OSSD response times” on page 106).

4.2.3 Maximum protective field range

Depending on the configured resolution and the variant used (see 4.2.1 “Resolution” on page 32), the maximum protective field range of the safety laser scanner is shown in the CDS.

Note The maximum protective field range of the S300 Mini must be sufficient to cover the calculated protective field size including the necessary supplements (see section 5.1.1 “Protective field size” on page 56).

[8] Radial distance to the safety laser scanner.

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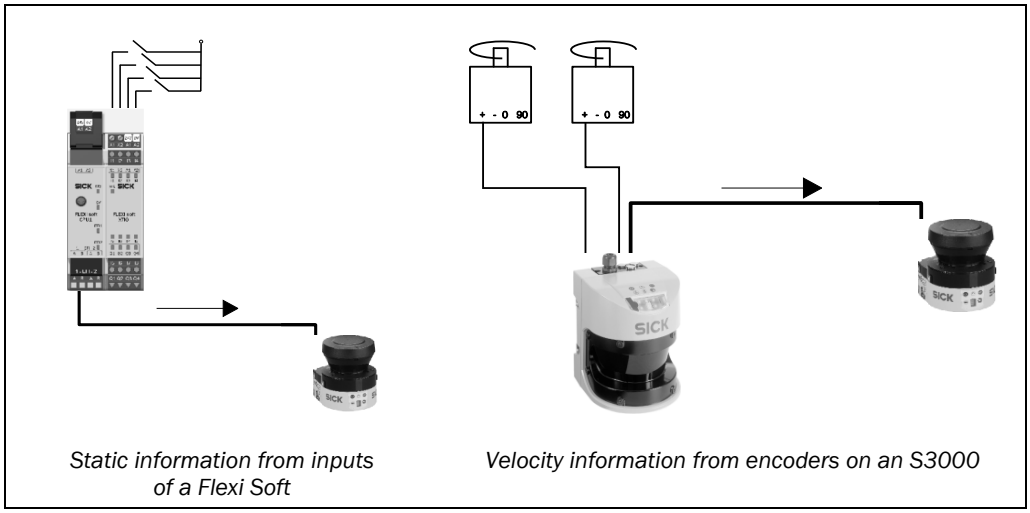
4.3 Inputs

Although the S300 Mini Remote does not have any local inputs, if it is operated on a Flexi Soft safety controller or on another safety laser scanner, you must still configure the inputs via which the S300 Mini Remote receives the input conditions via EFI.

Fig. 16: Input conditions via EFI



Static information from inputs of a Flexi Soft

Velocity information from encoders on an S3000

Activate the inputs you want to use for monitoring case switching.

If the S300 Mini is connected to a Flexi Soft safety controller, up to five dual-channel control inputs can be configured.

If you activate the **Use velocity** option, you can use velocity ranges for monitoring case switching.

4.3.1 Input delay

If the control device via which you switch the static control inputs cannot switch within 10 ms to the related input condition (e.g. due to switch bounce times), you must configure an input delay. For the input delay choose the time in which your defined control device can switch to a corresponding input condition.

The following figures, based on experience, give input delays for various methods of switching.

Tab. 8: Figure from experience for the necessary input delay

Switching method	Input delay required
Electronic switching using controller or complementary electronic outputs with 0 to 10 ms bounce time	10 ms
Contact (relay) controls	30-150 ms
Control using independent sensors	130-480 ms

Note Also pay attention to the notes in section 5.6 “Time for monitoring case switching” on page 70.

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4.3.2 Sampling for the static control inputs

If you are using static sampling, decide between complementary or 1-of-n sampling depending on the control features available. Depending on this selection you can define the switching criteria for the monitoring cases (see section 4.8.1 “Monitoring case switching via static input information” on page 46).

Complementary sampling

One control input comprises two connections. For correct switching one connection must be inverted in relation to the other.

The following table shows the levels that must be present at the connections for the control input to define the logical input state 1 and 0 at the related control input.

Tab. 9: Level at the connections for the control inputs for complementary sampling

A1	A2	Logical input state
1	0	0
0	1	1
1	1	Error
0	0	Error

1-of-n sampling

With 1-of-n sampling you use the single connections of the control input pairs.

Tab. 10: Truth table for 1-of-n sampling with two input pairs

A1	A2	B1	B2	Result (e.g. monitoring case no.)
1	0	0	0	1
0	1	0	0	2
0	0	1	0	3
0	0	0	1	4
0	0	0	0	Error
1	1	0	0	Error

Notes

- All connections must be connected.
- Only one connection is ever allowed to be 1.

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4.4 Universal I/O connections of the S300 Mini Standard

WARNING

You are not allowed to use the universal I/O connections for safety-relevant functions!

You are only allowed to use the universal I/O connections for signaling. You must never use the signals for controlling the application or for safety-relevant functions.

The S300 Mini Standard has two universal I/O connections (see section 6.1.1 “Round plug connector S300 Mini Standard” on page 80). You can configure these two connections for the following functions:

- inactive (factory default setting)

As inputs (it is only possible to select one function per universal I/O connection):

- stand-by
- external device monitoring (EDM) (see section 4.5.3 on page 37)
- resetting the restart interlock (see section 4.6 on page 37)

As outputs (it is possible to select several functions per universal I/O connection, these functions are linked together using an OR operator):

- device error
- contamination error
- contamination warning
- second warning field
- reset required

Note Other functions that can be configured are dependent on the configuration of the universal I/O connections. For example, you can only realize a restart interlock if you configure one of the universal I/Os as an input for resetting the restart interlock.

The universal I/O connections are configured in the CDS in the **Universal I/O** area. Fig. 17 shows a configuration example.

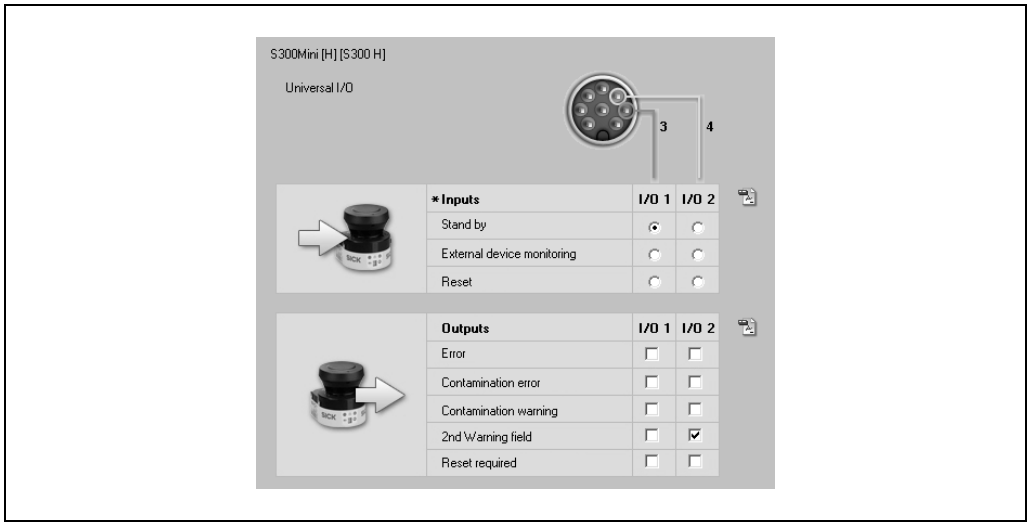

Fig. 17: Configuration example universal I/O connections of the S300 Mini Standard

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Stand-by

If, in mobile applications, vehicles are not moved for a time, the OSSDs can be switched to the OFF state and the laser on the S300 Mini can be switched off. In this way the power consumption of the device is reduced.

Recommendation Use this function if, e.g. you use several vehicles and do not move them for a time.

The S300 Mini remains in the stand-by mode as long as the related input information is present.

4.5 OSSDs

4.5.1 External OSSDs of the S300 Mini Remote

On the S300 Mini Remote you can define in the CDS which external output signal switching device (OSSD) is switched on a device connected via EFI if there is an object in the protective field.

The S300 Mini transmits the status of the field sets (protective field/warning fields) via EFI. The OSSDs on another device connected via EFI have switched.

- Connected S300 or S3000: The OSSDs on the second safety laser scanner are switched.
- Connected safety controller (e.g. Flexi Soft): The OSSDs on the safety controller are switched depending on its configuration.
- Connected network solution (e.g. safety remote I/O): The information is passed via the network e.g. to an FPLC that must shutdown the dangerous state.

The status of the protective fields is transmitted using EFI and can be combined in the Flexi Soft safety controller as required. The signal of the safety outputs on the Flexi Soft safety controller is transferred, e.g., to a machine or vehicle control.

WARNING

Pay attention to the logical values for the protective field status information on transfer to the Flexi Soft safety controller!

The status of an evaluated protective field is logical 1 if the protective field is unoccupied, the status is logical 0 if the protective field is infringed (see section 12.5 “EFI status information and control commands” on page 115). The status of a protective field that is **not evaluated** is always logical 1.

4.5.2 Internal OSSDs of the S300 Mini Standard

If there is an object in the protective field, the internal OSSDs on the S300 Mini Standard always switch. This can **not** be configured differently in the CDS.

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4.5.3 External device monitoring (EDM) S300 Mini Standard

The EDM checks if the contactors actually de-energize when the protective device is tripped. If you activate external device monitoring, then the S300 Mini checks the contactors after each interruption of the protective field and prior to the machine restart. The EDM can so identify if one of the contactors has welded, for instance. In this case the external device monitoring places the system in a safe operational state and the OSSDs are not switched back to the ON state.

The table shows how the S300 Mini Standard reacts if the external device monitoring detects a contactor malfunction:

Tab. 11: Behavior of the S300 Mini Standard on a contactor malfunction

Without internal restart interlock or with restart delay	• The system locks completely (lock-out). • The error message 8. appears in the 7-segment display.
With restart interlock	• The S300 Mini switches its OSSDs to the OFF state. • The LED EDM is illuminated. • The error message 8 appears in the 7-segment display.

You can configure the external device monitoring in the CDS.

Note You will find examples on the connection of the external device monitoring in section 7.3 “Connection diagrams” on page 86.

4.6 Restart of the S300 Mini Standard

You can configure the restart behavior of the S300 Mini Standard as follows:

- without restart interlock
- with restart delay
- with restart interlock

You can configure the type of restart in the CDS.

Note The S300 Mini Remote can only be operated on an S3000/S300 safety laser scanner, on a Flexi Soft safety controller or on a sens:Control device via EFI. If you need a restart interlock, then you must configure and install it on this device.

WARNING

It is imperative that you configure the S300 Mini or the application with restart interlock if the protective field can be left to approach the hazardous point or if a person cannot be detected by the S300 Mini at every point in the hazardous area!

During the assessment, pay attention to whether the protective field can be left in the direction of the hazardous point, to areas that are unprotected due to the mounting and the unprotected near range of the S300 Mini (see section 5.5 “Methods of preventing unprotected areas” on page 68).

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Configuration of the S300 Mini without restart interlock

After the OSSDs on the S300 Mini have been switched to the OFF state due to an object in the protective field, the OSSDs are re-enabled again immediately when there is no longer an object in the active protective field.

This configuration is only allowed ...

- if an external restart interlock is realized on the machine controller

or

- if the protective field **cannot** be left in the direction of the hazardous point and if people can be detected by the S300 Mini **at every point in the hazardous area**!

Restart delay for mobile applications

In mobile applications you can configure a restart delay from 2 to 60 seconds on the S300 Mini. The OSSDs on the S300 Mini switch to the ON state if there is no object in the protective field for the duration given.

This configuration is only allowed if the protective field **cannot** be left in the direction of the hazardous point and if a person can be detected **at every point in the hazardous area** by the S300 Mini!

Configuration of the S300 Mini with restart interlock

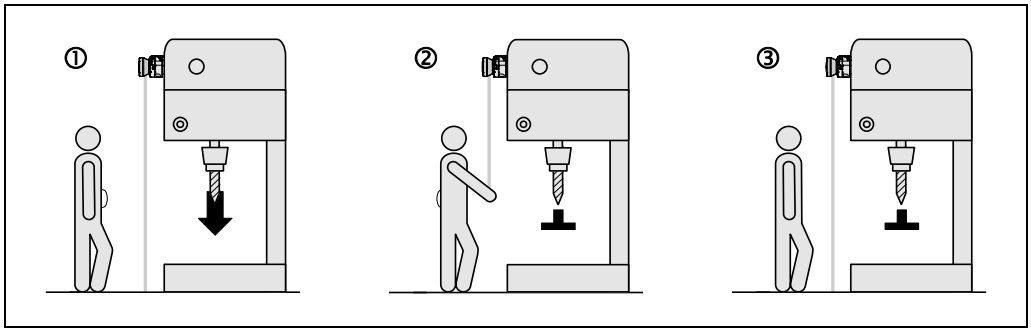

Fig. 18: Schematic outline of the operation with restart interlock

Note Do not confuse the restart interlock with the starting interlock on the machine. The starting interlock prevents the machine starting after switching on. The restart interlock prevents the machine starting again after an error or a protective field infringement.

The OSSDs on the S300 Mini switch to the OFF state to initiate a machine ① or vehicle stop as soon as there is an object in the protective field ②. They do not switch to the ON state ③, even if there is no longer an object in the protective field. The OSSDs only change to the ON state if the operator operates the control switch for restart or reset.

WARNING

Place the control switch for restart or reset outside the hazardous area in a place where it can clearly be seen from the hazardous area!

Place the control switch for restart or reset outside the hazardous area such that it cannot be operated by a person in the hazardous area. Ensure that the person who operates the control switch has a full view of the hazardous area.

Notes

- You will find examples on the connection of the internal restart interlock in section 7.3 “Connection diagrams” on page 86.
- If you do not use the internal restart interlock, then do **not configure any** of the universal I/Os as an input for resetting (see section 4.4 on page 35).

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Reset

Note The reset function is often also called “preparation for restart”. In these operating instructions the term **reset** is used.

If you want to activate the restart interlock on the S300 Mini (internal) and also a restart interlock on the machine (external), then each restart interlock has its own control switch.

After operating the control switch for the internal restart interlock (with protective field unoccupied) ...

- the S300 Mini Standard switches its OSSDs to the ON state.
- the LED ⓥ on the S300 Mini Standard illuminates green.

The external restart interlock prevents the machine from restarting. After resetting the S300 Mini the operator must press the control switch to restart the machine controller.

WARNING

Ensure that the correct sequence is followed!

The controller must be realized such that the machine only restarts if the S300 Mini is first reset and then the control switch for restarting the machine controller is operated.

Reset signals

If the S300 Mini safety laser scanner is operated using the “With restart interlock” function, then after a protective field infringement and the subsequent clearing of the protective field, it requests a reset signal from the control system (reset required).

WARNING

The reset signal must be safety-related (single failure proof)!

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4.7 Field sets

The number of field sets that can be configured is dependent on the safety laser scanner variant. The following table shows the number of field sets per variant:

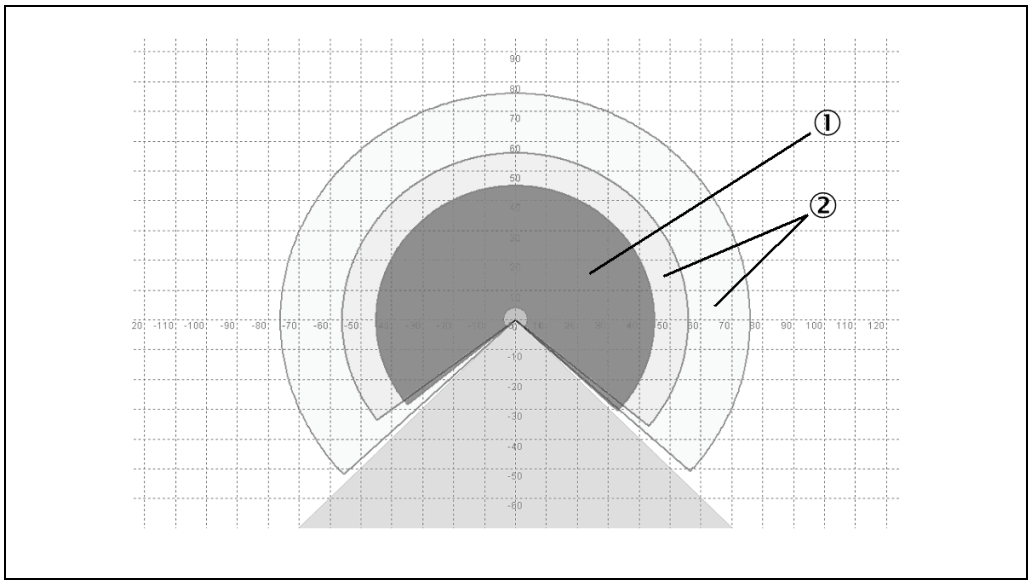
Tab. 12: Number of field sets that can be configured per variant

	Standard	Remote
Number of field sets	1	16

4.7.1 Configuring the protective field and warning field

With the aid of the CDS you can configure the field set, which comprises a protective field ① and two warning fields ②. During this process you configure the shape and size of the protective and warning fields. You can realize any field shape required.

Fig. 19: Creating a field set in the CDS



Note

The area to be monitored is scanned radially by the S300 Mini. The S300 Mini cannot see through objects during this process. The area behind objects that are in the area to be monitored (pillars, grilles, etc.) can thus not be monitored.

Protective fields and warning field can cover up an angle of up to 270° and have different radial scanning ranges depending on the variant and the resolution configured (see section 4.2.1 “Resolution” on page 32).

WARNING

Check the protective fields configured!

Prior to commissioning the machine or vehicle, check the configuration of the protective fields. Please observe the notes in chapter 9 “Commissioning” on page 92 and in the checklist on page 126.

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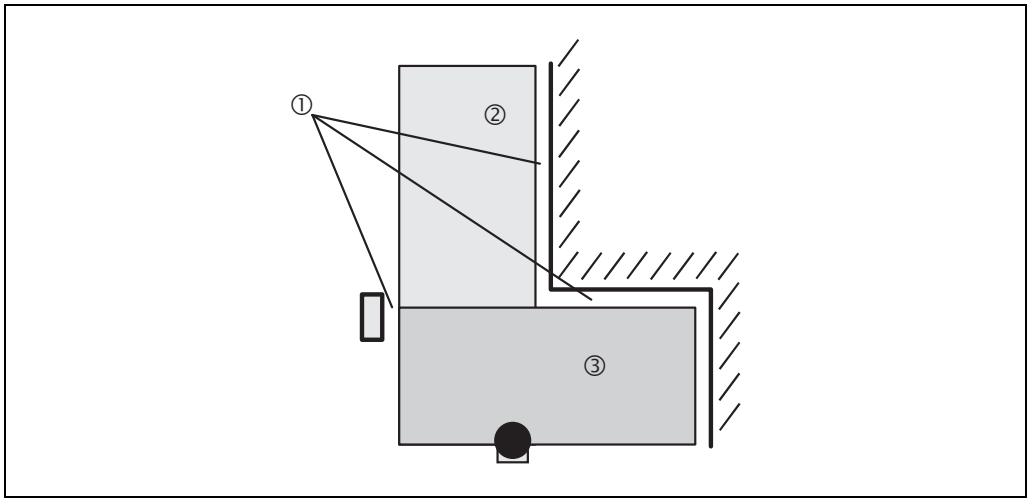
Note If the protective field ③ or the warning fields ② stretch as far as a wall or another object (pillar, neighboring machine, shelf), there should be a distance of 100 mm between the protective field or warning field and the object to prevent false triggering ①.

Fig. 20: Configuring protective field and warning field



WARNING

Secure unprotected areas!

If it is possible to access a narrow strip between the protective field and a wall or another object, you must protect this strip using additional measures (e.g. fence or floor protection).

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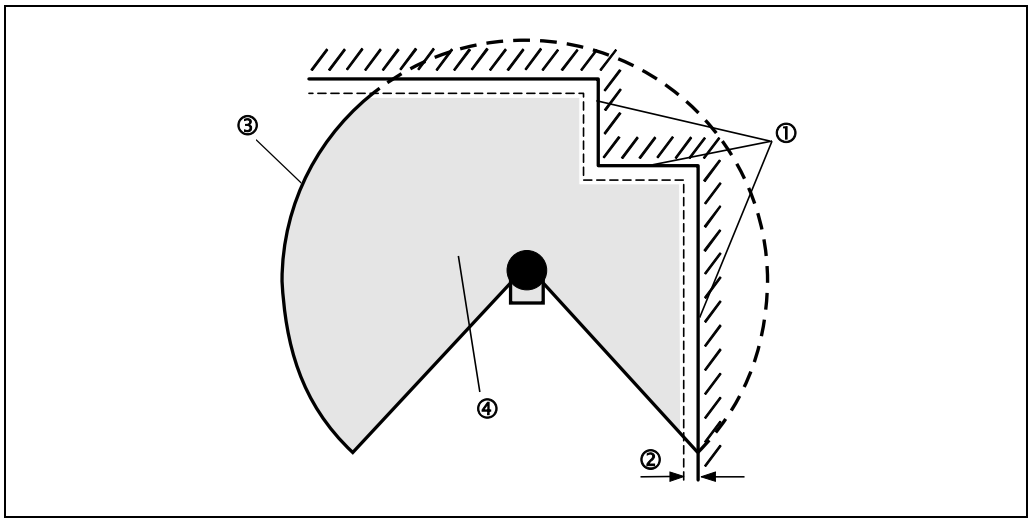
4.7.2 Protective field or warning field suggested by the safety laser scanner

The CDS can suggest the protective field or warning field in the field set editor. The safety laser scanner scans the visible surrounding contour several times. From the data obtained the CDS suggests the contour and size of the field. The following figure shows an example for the reading of a protective field:

Fig. 21: Reading the protective field



In those places at which the surrounding contour is smaller than the maximum protective field range (e.g. at ①), the protective field ④ corresponds to the surrounding contour.

Note The measuring error tolerances for the S300 Mini are automatically subtracted from the protective field size. As a result the protective field is slightly smaller than the surface covered ②.

In those places where the surrounding contour is larger than the protective field range ③, the protective field corresponds to the possible scanning range.

WARNING

Check the protective field suggested!

The protective field suggested by the CDS is not a replacement for the calculation of the minimum distance. Calculate the minimum distance and check the effectiveness of the protective fields prior to commissioning the application!

Pay attention to the descriptions in chapter 5 “Mounting” on page 54, the notes in chapter 9 “Commissioning” on page 92 and the checklist on page 126.

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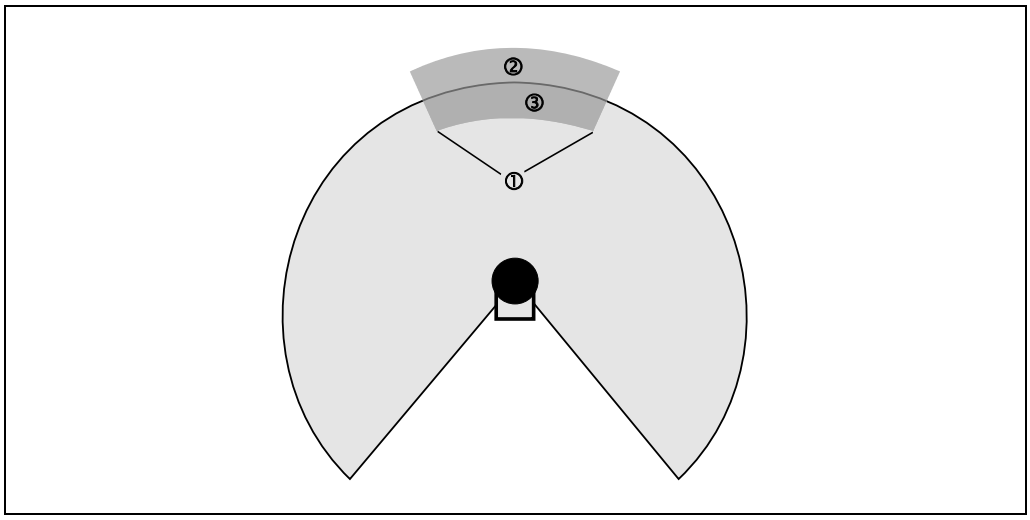
4.7.3 Using the contour as a reference

In addition to the protective field, the S300 Mini can also monitor a contour (e.g. the floor in vertical applications).

Fig. 22: Schematic diagram of contour as reference



For contour monitoring you define a contour segment ①. The contour segment comprises a positive ② and a negative ③ tolerance band.

The OSSDs on the S300 Mini Standard switch to the OFF state or the S300 Mini Remote signals **Protective field infringed**, if ...

- there is an object in the protective field.
- the monitored surrounding contour is no longer in the tolerance band (e.g. if the position of the S300 Mini is changed).

Notes

- You can define any number of contour segments.
- The contour segments must not be narrower than the configured resolution.
- At the points where a contour has been configured as a reference you cannot define warning fields. If, for example, you use the floor as a reference for access protection, you cannot configure a warning field there. However, you can, e.g., configure a warning field to the left and right of the contour segment to control a warning signal on approach from the side.
- The contour as reference function and the warning field 2 function are mutually exclusive.

You define the contour as a reference in the CDS field set editor.

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Vertical operation

In vertical operation (for access protection and hazardous point protection) according to CLC/TS 61496-3 you **must** always configure the protective fields used with the contour as reference function.

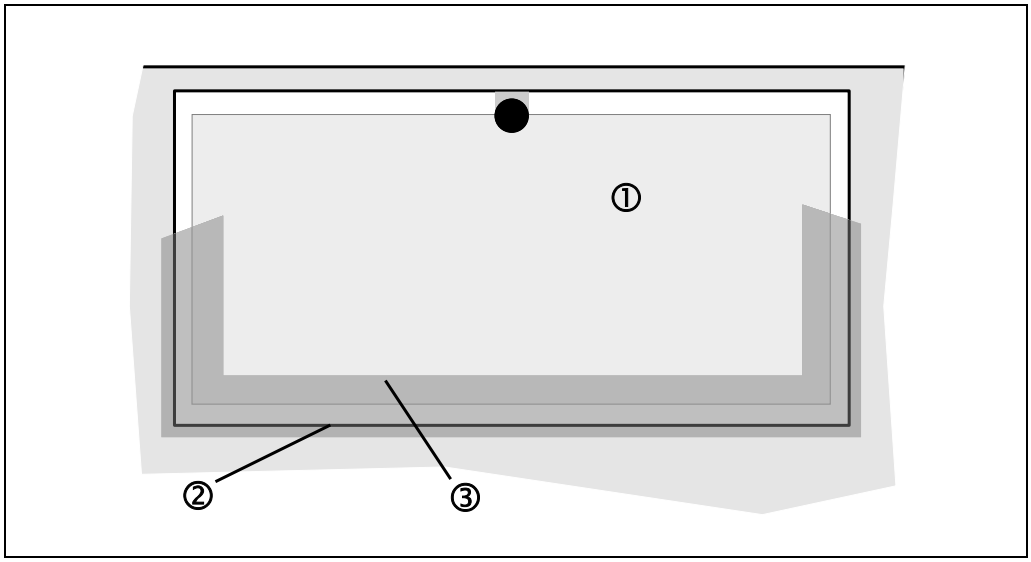

Fig. 23: Contour as reference for vertical operation
① Protective field
② Contours of the machine opening
③ Contour segment

Recommendation Use lateral, vertical boundaries of the opening (e.g. door frame) and the floor as reference. If in this case the position of the S300 Mini is changed in one or more planes, the distance to the reference changes and the S300 Mini Standard switches its OSSDs to the OFF state or the S300 Mini Remote signals **Protective field infringed**.

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4.8 Monitoring cases

The S300 Mini supports a configuration with multiple monitoring cases. By switching the monitoring case on the S300 Mini Remote you can switch to different monitoring conditions in the case of a change to the monitoring situation.

WARNING

Ensure for each monitoring case that the minimum distance to the hazardous area is maintained!

See chapter 5 “Mounting” on page 54.

The number of monitoring cases that can be configured is dependent on the variant. The following table shows the number of monitoring cases:

Tab. 13: Number of monitoring cases per variant and application

Standard	Remote
Applications with static control inputs via EFI (e.g. on a Flexi Soft)	
–	32
Applications with dynamic control inputs via EFI	
–	32

You can configure the monitoring cases in the CDS.

Each monitoring case includes ...

- the input conditions, the so-called control signals, that control the activation of the monitoring case.
- a field set, comprising of protective field and warning field or fields.
- if necessary, a unique follow-on case or two alternative follow-on cases.
- the multiple sampling for the field set.

Monitoring cases can be switched with the following input information:

- static information
- velocity information
- a combination of both

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4.8.1 Monitoring case switching via static input information

➢ For monitoring case switching via static input information, configure for each monitoring case the input combination to be used to switch to this monitoring case.

WARNING

When switching the monitoring cases using static control inputs, please note the following points:

➢ Ensure that the control — using static control inputs — provides switching between the monitoring cases in the correct time frame. Note that at the time of the switching there may be a person in the protective field. Only by means of switching in the correct time frame (i.e. before the hazard occurs at this point for the person) is protection provided (see section 5.6 “Time for monitoring case switching” on page 70).

Static complementary sampling

From these five pieces of input information **A**, **B**, **C**, **D** and **E**, 2^5 = 32 combinations can be represented. As a result unique input conditions can be configured for 32 monitoring cases.

Tab. 14: Truth table with complementary evaluation

A	B	C	D	E	E.g. case
0	0	0	0	0	1
1	0	0	0	0	2
0	1	0	0	0	3
1	1	0	0	0	4
0	0	1	0	0	5
1	0	1	1	0	6
0	1	1	0	0	7
1	1	1	0	0	8
...					...
0	1	1	1	0	15
1	1	1	1	0	16
0	0	0	0	1	17
...					...
0	1	1	1	1	31
1	1	1	1	1	32

Note Undefined input information will result in the S300 Mini Remote signaling **Protective field infringed**.

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Static 1-of-n sampling

With 1-of-n sampling you use the single connections of the control input pairs.

Notes

- Using external inputs (e.g. those of a Flexi Soft safety controller, see fig. “Configuring protective field and warning field” on page 41) maximally ten input connections can be used.
- All connections must be connected!
- One connection must be 1!
- Only one connection is ever allowed to be 1!

Tab. 15: Truth table for 1-of-n sampling

A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	E.g. case
1	0	0	0	0	0	0	0	0	0	1
0	1	0	0	0	0	0	0	0	0	2
0	0	1	0	0	0	0	0	0	0	3
0	0	0	1	0	0	0	0	0	0	4
0	0	0	0	1	0	0	0	0	0	5
0	0	0	0	0	1	0	0	0	0	6
0	0	0	0	0	0	1	0	0	0	7
0	0	0	0	0	0	0	1	0	0	8
0	0	0	0	0	0	0	0	1	0	9
0	0	0	0	0	0	0	0	0	1	10
1	1	0	0	0	0	0	0	0	0	Error
0	0	0	1	1	0	0	0	0	0	Error
0	0	0	0	0	0	0	0	0	0	Error
and all other combinations										Error

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4.8.2 Monitoring case switching via velocity information

WARNING

When switching the monitoring cases using dynamic control inputs, please note the following points:

➢ Ensure that the control — using dynamic control inputs (incremental encoder inputs) — provides switching between the monitoring cases in the correct time frame. Note that at the time of the switching there may be a person in the protective field. Only by means of switching in the correct time frame (i.e. before the hazard occurs at this point for the person) is protection provided (see section 5.6 “Time for monitoring case switching” on page 70).

For monitoring case switching via velocity information (dynamic switching), configure for each monitoring case the velocity range within which the monitoring case is switched.

Example:

- Monitoring case 1 (standstill) –10 ... +10 cm/s
- Monitoring case 2 (forward movement 1) 11 ... 50 cm/s
- Monitoring case 3 (forward movement 2) 51 ... 100 cm/s
- Monitoring case 4 (forward movement 3) 101 ... 200 cm/s

The S300 Mini Remote receives velocity information via EFI. It switches to one of the monitoring cases configured depending on the velocity received.

Note During the configuration of the monitoring cases in the CDS, you must cover **all possible or allowed velocities** of the vehicle. An undefined velocity will result in the S300 Mini Remote signaling **Protective field infringed** (useful e.g. for safe maximum velocity monitoring on vehicles).

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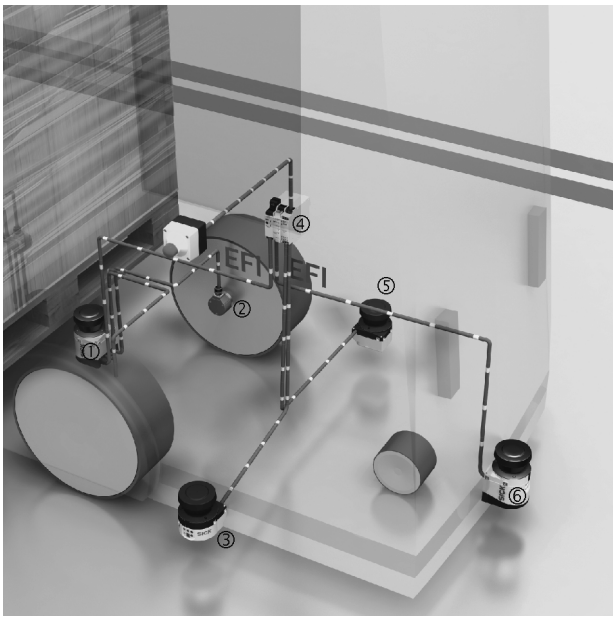
4.8.3 Velocity routing via EFI

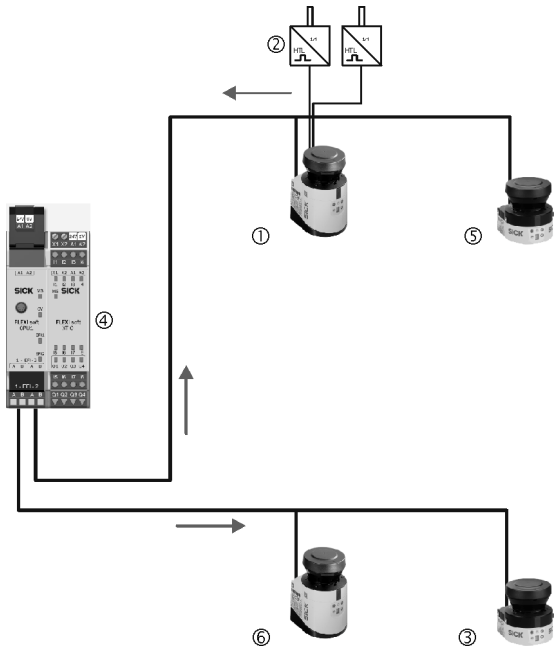
If several safety laser scanners are connected to a Flexi Soft safety controller, then a velocity routing can be configured. In this way the velocity information that is determined e.g. by an S3000 Professional or Expert or an S300 Professional or Expert with the aid of incremental encoders is distributed to all safety laser scanners.

Fig. 24: Example for velocity routing on an AGV
① S300 Expert on EFI1.1
② Incremental encoder
③ S300 Mini on EFI2.2
④ Flexi Soft
⑤ S300 Mini on EFI1.2
⑥ S300 on EFI2.1



On the S300 Expert on EFI1.1 ① incremental encoders ② are connected. These generate the necessary velocity signals. The signals are distributed by the Flexi Soft safety controller ④ to all **four** safety laser scanners (① and ⑤ as well as ③ and ⑥) and are available on all **four** safety laser scanners for monitoring case switching.

Fig. 25: Connection diagram for velocity routing
① S300 Expert on EFI1.1
② Incremental encoder
③ S300 Mini on EFI2.2
④ Flexi Soft
⑤ S300 Mini on EFI1.2
⑥ S300 on EFI2.1



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How to configure a velocity routing in the Flexi Soft Designer:

➢ Configure the velocity routing in the Flexi Soft Designer for instance as in the following figure.

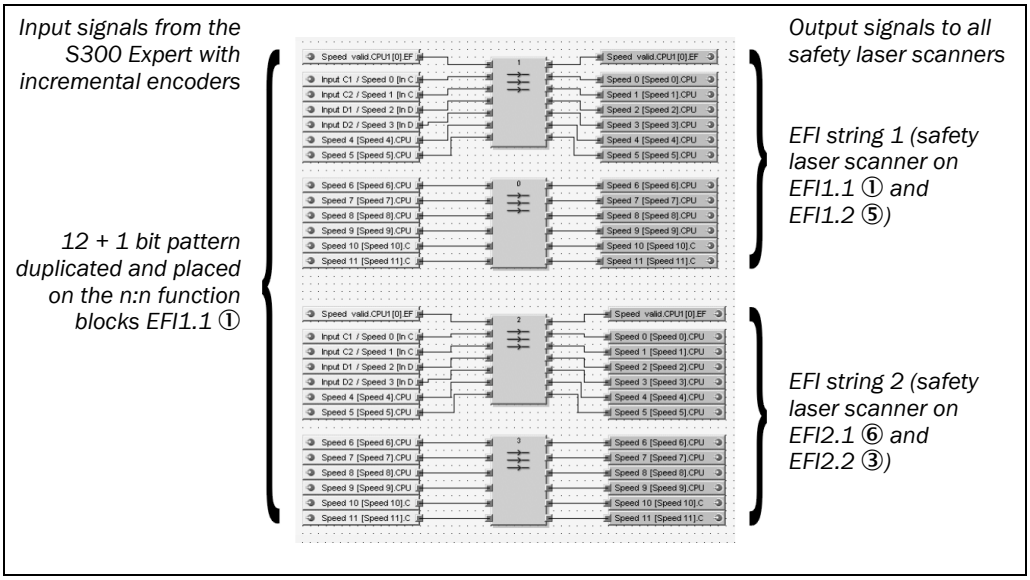
Input signals from the S300 Expert with incremental encoders
12 + 1 bit pattern duplicated and placed on the n:n function blocks EFI1.1 ①
Output signals to all safety laser scanners
EFI string 1 (safety laser scanner on EFI1.1 ① and EFI1.2 ⑤)
EFI string 2 (safety laser scanner on EFI2.1 ⑥ and EFI2.2 ③)

Fig. 26: Example for velocity routing in the Flexi Soft Designer

The velocity signals of the S300 or S3000 Expert are broken down into a 12 + 1 bit pattern, 12 velocity bits and one bit for validation. These signals are available as input signals, are duplicated and placed **twice** on the n:n function blocks (0 and 1 as well as 2 and 3).

The outputs of the function blocks are placed on EFI string 1 or on EFI string 2. As a result they are available to all four safety laser scanners.

WARNING

The "Speed valid" status information is relevant for safety!

Ensure that the **Speed valid** input signal is connected to the **Speed valid** output signal.

How to configure the safety laser scanners in the CDS:

➢ On the **Incremental encoder** tab for the safety laser scanner to which the incremental encoders are connected, select the **Indicate velocity** option.

All safety laser scanners, also the sending devices, must use these velocity signals via EFI.

➢ For this reason activate on all safety laser scanners on the **Inputs** tab the option **Use Flexi Soft CPU1**.

➢ Then, select **on all** safety laser scanners on the **Inputs** tab the **Use velocity** option.

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4.8.4 Multiple sampling

If multiple sampling is set, an object must be scanned several times before the S300 Mini Standard switches its OSSDs to the OFF state or the S300 Mini Remote signals a protective field infringement via EFI. In this way you can reduce the probability that insects, welding sparks or other particles result in the shutdown of the system.

If a multiple sampling of 3 is configured, for instance, an object must be detected in the protective field three times in succession before the S300 Mini Standard switches the OSSDs to the OFF state or the S300 Mini Remote signals **Protective field infringed**.

WARNING

The total response time is increased by the multiple sampling!

With a multiple sampling greater than 2, note that you must add a supplement to the basic response time (see section 12.2 “OSSD response times” on page 106)!

On the S300 Mini, a multiple sampling of 2 is the minimum setting. You can set the multiple sampling to up to 16 with the aid of the CDS. The supplement to the basic response time resulting from your setting is displayed in the CDS.

Tab. 16: Recommended multiple sampling

Application	Recommended multiple sampling
Stationary under clean ambient conditions	2 times
Vertical applications	2 times
Mobile	4 times
Stationary under dusty ambient conditions	8 times

Recommendation

Using multiple sampling you can increase the availability of a system.

You can configure the multiple sampling in the CDS. You can set individual multiple sampling for each monitoring case.

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4.8.5 Checking the monitoring case switching on the S300 Mini Remote

To check the switching between monitoring cases, configure a series of monitoring cases. Here you can define either an arbitrary sequence, a unique sequence, or two alternative sequences.

- Arbitrary sequence: It is allowed to switch from one monitoring case to any other defined monitoring case.
- Unique sequence: It is only allowed to switch from a monitoring case to another specifically defined monitoring case.
- Alternative sequence: It is allowed to switch from a monitoring case to one of two specifically defined monitoring cases.

Recommendation Use the monitoring of the monitoring case switching as an additional check on your control. For example, in this way deviations of a vehicle from a corridor or a system from the stipulated production process can be detected.

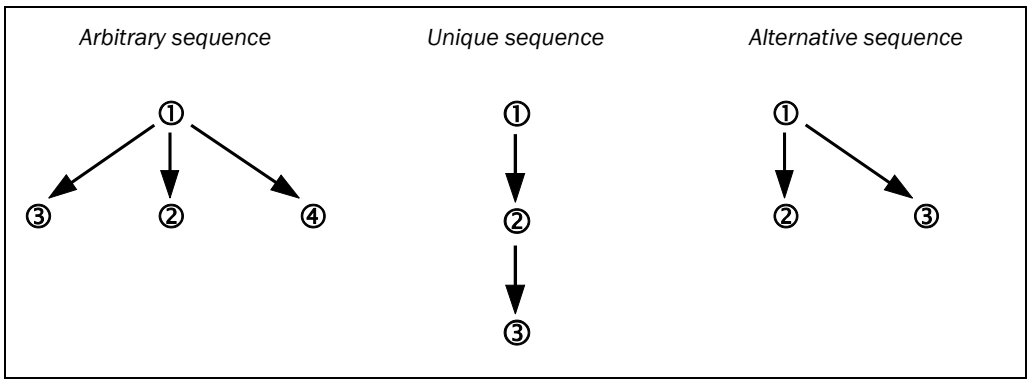

Fig. 27: Schematic layout of the monitoring case switching

You can configure the sequence of monitoring cases in the CDS.

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4.8.6 Park/stand-by mode

If, in mobile applications, vehicles are not moved for a time (e.g. for battery charging), the OSSDs can be switched to the OFF state and the laser on the S300 Mini can be switched off. In this way the power consumption of the device is reduced.

In this way you also prevent the safety laser scanners from dazzling each other and entering an error condition.

The function can be realized with the aid of the park mode or the stand-by mode

Note As in an EFI system with the S300 Mini Remote you use the OSSDs on another safety laser scanner, the OSSDs on this safety laser scanner switch to the OFF state, as soon as the S300 Mini Remote or the other safety laser scanner is switched to the park/stand-by mode.

Park mode of the S300 Mini Remote

To switch to the park mode, configure a monitoring case for which the park mode is defined in the CDS.

The S300 Mini Remote needs the response time resulting from the configuration to switch from the park mode to another monitoring case.

Stand-by mode

In order to switch to the stand-by mode, on the S300 Mini Standard one universal I/O connection must be configured as stand-by input. (see section 4.4 “Universal I/O connections of the S300 Mini Standard” on page 35).

On the S300 Mini Remote you can switch to the stand-by mode via EFI (see section 12.5 “EFI status information and control commands” on page 115).

Note A monitoring case is not occupied by the stand-by mode.

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5 Mounting

This chapter describes the preparation and completion of the mounting of the S300 Mini safety laser scanner.

Mounting requires four steps:

- definition of the application and the necessary mounting location for the safety laser scanner
- calculation of the protective field sizes and minimum distances (see EN ISO 13855)
- definition of the switching point between monitoring cases (only S300 Mini Remote)
- mounting the safety laser scanner with or without mounting kits

WARNING

No protective function without sufficient minimum distance!

Only if you configure the protective field such that there is an adequate minimum distance to the hazardous area, is protection by the S300 Mini ensured.

Notes

- ➢ Mount the S300 Mini in a dry place and protect the device from dirt and damage.
- ➢ Avoid the installation of the S300 Mini in the vicinity of strong electric fields. These can, e.g., be produced by welding cables, induction cables in the immediate vicinity and also by mobile telephones operated nearby.
- ➢ Ensure that there are no obstacles in the area to be monitored in the field of view of the S300 Mini that could cause interference or shadowing. Such shadowed areas cannot be monitored by the S300 Mini. If there are unavoidable shadowed areas, check whether there is a risk. Take additional safety precautions as necessary.
- ➢ Keep the area to be monitored free of smoke, fog, steam or other forms of air impurities. There must not be any condensation on the optics cover. Otherwise the function of the S300 Mini may be impaired and incorrect switching may occur.
- ➢ Avoid placing highly reflective objects in the scan plane of the S300 Mini. Examples: Retroreflectors can affect the measurement results of the S300 Mini. Highly reflective objects within the protective field can blank a part of the area to be monitored in certain circumstances.
- ➢ Mount the S300 Mini such that it is not dazzled by incident sunlight. Do not position stroboscopic and fluorescent lights or other strong light sources directly in the scan plane as these may affect the S300 Mini in specific circumstances.
- ➢ Mark the protective field on the floor, if this is reasonable for the application (see EN 61496-1, chapter 7).

The following steps are necessary after mounting:

- completing the electrical connections (chapter 6 “Electrical installation”)
- configuration of the protective field (chapter 8 “Configuration”)
- commissioning and checking of the installation (chapter 9 “Commissioning”)
- checking the function and safe shutdown (section 9.2 “Test notes”)

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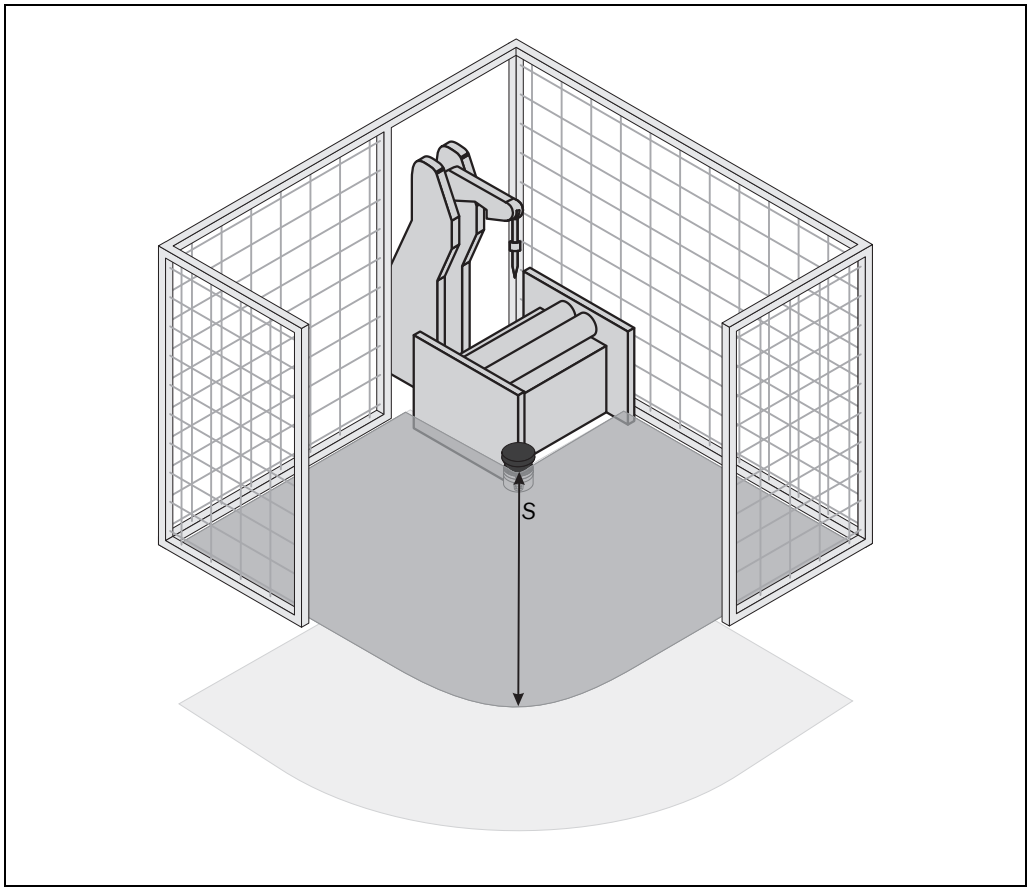
5.1 Stationary application in horizontal operation

This type of protective device is suitable for machines and systems on which, e.g. a hazardous area is not completely enclosed by a guard.

Fig. 28: Horizontal stationary application



For a horizontal stationary application determine ...

- the protective field size to observe the necessary minimum distance.
- the height of the scan plane.
- the restart behavior.
- measures to protect any areas not covered by the S300 Mini.

Note Once you have defined the protective field size, mark the boundaries of the protective field on the floor. In this way you will make the protective field boundaries visible for the operator and ease subsequent testing of the protective function.

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5.1.1 Protective field size

The protective field must be so configured that a minimum distance (S) to the hazardous area is maintained. This safety distance ensures that the hazardous point can only be reached after the dangerous state of the machine has been completely stopped.

Note If you are using an S300 Mini Remote, you can define several monitoring cases with different protective fields. In such a case you must calculate the protective field size for all protective fields used.

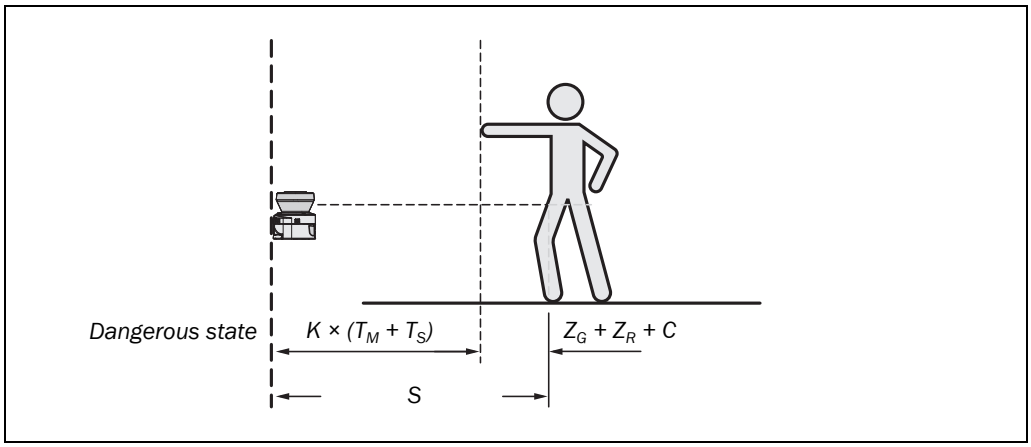
You can operate the S300 Mini in stationary horizontal operation with 30, 40, 50 or 70 mm resolution. The maximum protective field range for the S300 Mini is given by the resolution.

WARNING

Ensure that a human leg can be detected with 70 mm resolution!

As per EN ISO 13855, mount the scan planes for horizontal stationary applications with 70 mm resolution at least 300 mm above the floor (see “Height of the scan plane at 70 mm resolution” on page 59).

Fig. 29: Minimum distance S



The minimum distance S depends on:

- approach speed of the body or parts of the body
- stopping/run-down time of the machine or system
  (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- response time of the S300 Mini
- supplements for general measurement errors and any measurement errors related to reflection
- supplement for prevention of reaching over
- height of the scan plane
- possibly the time for switching between the monitoring cases

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How to calculate the minimum distance S (see EN ISO 13 855):

➢ First, calculate S using the following formula:

$S = (K \times (T_M + T_S)) + Z_G + Z_R + C$

Where ...

K = Approach speed (1600 mm/s, defined in EN ISO 13 855)
T_M = Stopping/run-down time of the machine or system
T_S = Response time of the S300 Mini and the downstream controller
Z_G = General safety supplement of the S300 Mini = 100 mm
Z_R = Supplement for measurement error related to reflection
C = Supplement for prevention of reaching over

Response time T_S of the S300 Mini

The response time T_S of the S300 Mini depends on ...

- the basic response time of the S300 Mini,
- the multiple sampling set,
- the transmission speed to external OSSDs via EFI.

See section 12.2 “OSSD response times” on page 106.

Supplement Z_R for measurement errors caused by reflection

WARNING

Avoid mounting retroreflectors at a distance of less than one meter from the boundary of the protective field!

With retroreflectors positioned at a distance of less than 1 m from the boundary of the protective field a supplement, Z_R, of 200 mm must be added to the protective field.

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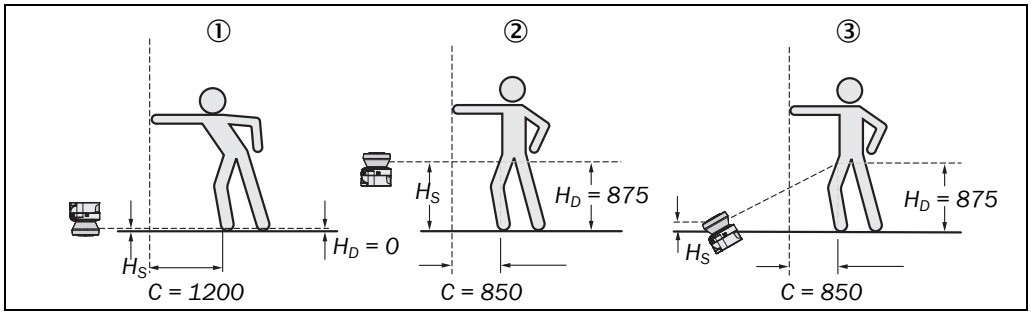
Supplement C for protection against reaching over

With a protective field installed horizontally, there is a risk that people may reach over the protective field and in this way reach the hazardous area before the S300 Mini shuts down the dangerous state. For this reason the calculation of the minimum distance must take into account a supplement to prevent persons from finding themselves in a hazardous situation by reaching over (see EN ISO 13857) before the S300 Mini triggers.

The necessary supplement for the minimum distance is dependent on the height of the scan plane for the protective field. At low heights ① the supplement is larger than at greater heights ② and ③.

Fig. 30: Mounting variations for the scan plane



In summary there are three usual variations of mounting the scan plane for the S300 Mini. The optimal variation depends on the related application. Tab. 17 provides assistance making the selection.

Tab. 17: Advantages and disadvantages of mounting variations
H_D = Detection height
H_S = Scanner mounting height

Mounting orientation	Benefit	Disadvantage
Safety laser scanner low (H_S < 300 mm) Low inclination of the scan plane ($H_D \approx H_S$)	Low external effects due to dazzle, crawling beneath not possible	Higher supplement C
Safety laser scanner high (H_S > 300 mm) Low inclination of the scan plane ($H_D \approx H_S$)	Lower protective field supplement C	Danger of crawling beneath (at the front and side)
Safety laser scanner low (H_S < 300 mm) High inclination of the scan plane ($H_D > H_S$)	Lower protective field supplement C	Danger of crawling beneath (at the front), external effect due to dazzle possible

WARNING

In case of scan planes at a height of more than 300 mm ensure that people cannot reach the hazardous area by crawling underneath the scan plane!

If you mount the protective device higher than 300 mm, you must prevent crawling beneath by means of additional measures. For applications that are accessible to the public, the mounting height may need to be reduced to 200 mm (on this subject see the appropriate regulations).

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How to calculate the supplement C:

- If there is enough empty space in front of your machine or system, use 1200 mm for the supplement C.
- If the minimum distance is to be kept as small as possible, calculate C using the following formula:
  $C = 1200\ mm - (0.4 \times H_D)$
  Here H_D is the height at which the protective field is mounted.

Note The minimum supplement C to prevent reaching over is 850 mm (arm length).

Height of the scan plane at 70 mm resolution

Due to the radial sampling of the protective field, the optical resolution will be lower the further away you get from the safety laser scanner.

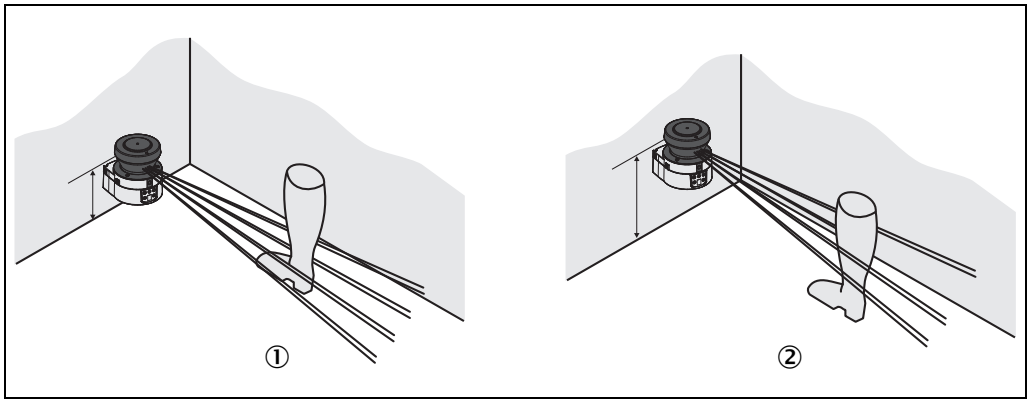

Fig. 31: Relationship between resolution and protective field mounting height

If you choose a resolution of 70 mm in the CDS for hazardous area protection, a human leg may, in certain circumstances, not be detected (e.g. scan to left and right of the bone ①).

If you mount the S300 Mini higher, the scan plane is at fibula height and the leg is also detected with an object resolution of 70 mm ②.

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5.2 Stationary vertical operation for access protection

Access protection can be used when the access to the machine can be defined by physical means. For access protection the S300 Mini detects the entry of an entire body.

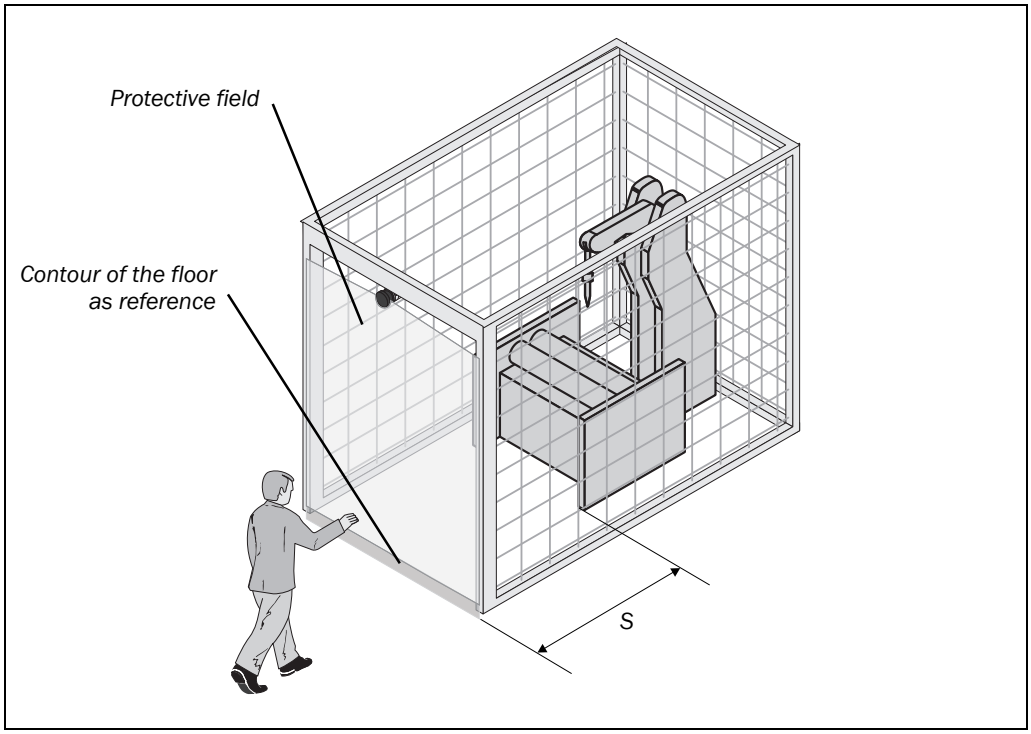
Notes

- To ensure adequate access protection, a response time of ≤ 90 ms and a resolution of 150 mm or finer are required.
- To protect the protective device against inadvertent adjustment or manipulation, you must use the contour of the surroundings as a reference for the S300 Mini (see section 4.7.3 “Using the contour as a reference” on page 43).

5.2.1 Minimum distance

For access protection, a minimum distance (S) must be maintained between protective field and hazardous area. This safety distance ensures that the hazardous point can only be reached after the dangerous state of the machine has been completely stopped.

Fig. 32: Access protection



The minimum distance S as defined in EN ISO 13 855 and EN ISO 13 857 depends on:

- reach or approach speed
- stopping/run-down time of the machine or system
  (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement. — On request SICK service can perform a stoptime measurement on your system.)
- response time of the S300 Mini
- supplement C against reaching through

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How to calculate the minimum distance S (see EN ISO 13 855):

➢ First, calculate S using the following formula:

$S = (K \times (T_M + T_S)) + C$

Where ...

K = Approach speed (1600 mm/s, defined in EN ISO 13 855)
T_M = Stopping/run-down time of the machine or system
T_S = Response time of the S300 Mini
C = Supplement against reaching through (850 mm)

Response time T_S of the S300 Mini

WARNING

The total response time of the S300 Mini must not be more than 80 ms for access protection!

If a critical response time is exceeded (for an object diameter of 150 mm and a speed of 1.6 m/s that is 90 ms) a person may no longer be detected under certain circumstances.

In specific cases agreed with the responsible authorities higher response times may be allowed (for example by increasing the detection time available by positioning the safety laser scanner at an angle). In this case ensure that the areas the safety laser scanner cannot see are protected by additional measures.

The response time T_S of the S300 Mini depends on ...

- the basic response time of the S300 Mini,
- the multiple sampling set,
- the transmission speed to external OSSDs via EFI.

See section 12.2 “OSSD response times” on page 106.

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5.3 Stationary vertical operation for hazardous point protection

Hazardous point protection is necessary if the operator must remain near the dangerous state of the machine. Hand protection is required for hazardous point protection.

Note

The S300 Mini must therefore be configured with a resolution of at least 40 mm.

WARNING

Never use the S300 Mini for safety applications in which finger protection is required!

Due to the finest possible resolution of 30 mm, the S300 Mini is not suitable for finger protection.

To protect the protective device against inadvertent adjustment or manipulation, you must use the contour of the surroundings as a reference for the S300 Mini (see section 4.7.3 “Using the contour as a reference” on page 43).

5.3.1 Minimum distance

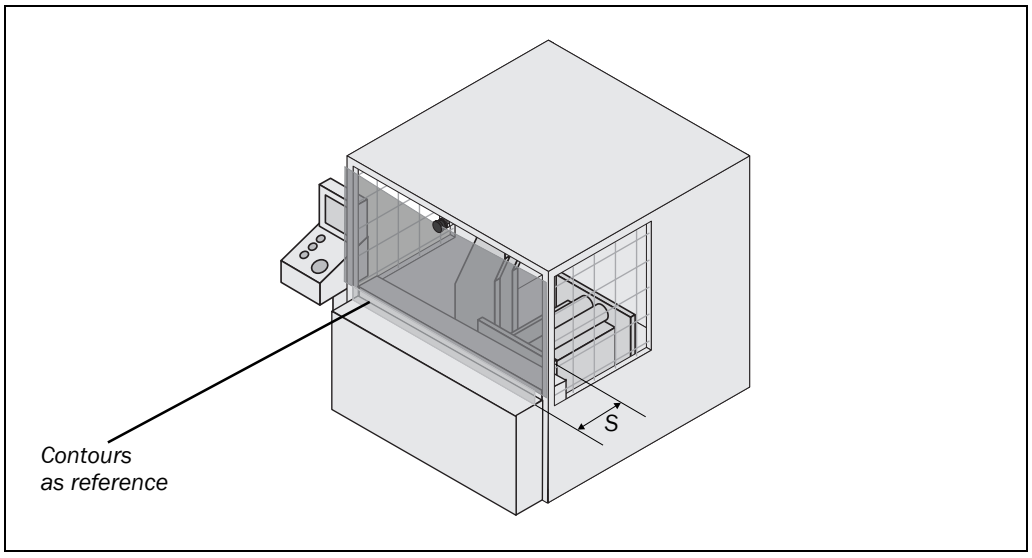
For hazardous point protection, a minimum distance must be observed between protective field and hazardous point. This safety distance ensures that the hazardous point can only be reached after the dangerous state of the machine has been completely stopped.

WARNING

Prevent reaching around or reaching behind the protective field!

Always mount the safety laser scanner such that reaching around and behind is impossible. Provide suitable additional precautions as necessary.

Fig. 33: Minimum distance to the hazardous area



The minimum distance S as defined in EN ISO 13 855 and EN ISO 13 857 depends on:

- stopping/run-down time of the machine or system
  (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- response time of the S300 Mini
- reach or approach speed
- resolution of the S300 Mini

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How to calculate the minimum distance S (see EN ISO 13 855):

➢ First, calculate S using the following formula:
$S = 2000 \times (T_M + T_S) + 8 \times (d - 14)$ [mm]

Where …

S = Minimum distance [mm]
T_M = Stopping/run-down time of the machine or system
T_S = Response time of the S300 Mini
d = Resolution of the S300 Mini [mm]

Note The reach/approach speed is already included in the formula.

➢ If the result S is ≤ 500 mm, then use the determined value as the minimum distance.

➢ If the result S is > 500 mm, you may be able to reduce the minimum distance using the following calculation:
$S = 1600 \times (T_M + T_S) + 8 \times (d - 14)$ [mm]

➢ If the new value S is > 500 mm, then use the newly calculated value as the minimum distance.

➢ If the new value S is ≤ 500 mm, then use 500 mm as the minimum distance.

Response time T_S of the S300 Mini

The response time T_S of the S300 Mini depends on …

- the basic response time of the S300 Mini,
- the multiple sampling set,
- the transmission speed to external OSSDs via EFI.

See section 12.2 “OSSD response times” on page 106.

5.4 Mobile applications

If the dangerous state is produced by a vehicle (e.g. AGV or fork lift), the hazardous area that is produced by the movement of the vehicle is protected by the S300 Mini.

Notes

- The S300 Mini may only be used to protect vehicles powered by electric motor.
- In the following calculations only take into account the velocity of the vehicle, not the speed of the person walking. This is based on the assumption that the person will recognize the danger and stand still.
- For vehicle protection, observe EN 1525 “Safety of industrial trucks. Driverless trucks and their systems”.
- If the application is to protect vehicles from collisions, then you may need to use different assumptions.

For a horizontally mounted mobile application, determine:

- protective field length
- protective field width
- height of the scan plane
- restart behavior
- methods of preventing unprotected areas

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5.4.1 Protective field length

You must configure the protective field such that a minimum distance to the vehicle is maintained. This ensures that a vehicle monitored by the S300 Mini comes to a stop before a person or object is reached.

If you are using an S300 Mini Remote, you can define several monitoring cases with different protective fields. You can switch them statically or dynamically via EFI.

In the case of dynamic switching, the vehicle velocity is determined using incremental encoders, the monitoring cases are switched as a function of the velocity. In such an application, the protective field sizes (in particular the protective field length) must be calculated for all velocities.

How to calculate the protective field length S_L (see EN ISO 13 855):

➢ Calculate the necessary protective field length S_L using the formula:

$S_L = S_A + Z_G + Z_R + Z_F + Z_B$

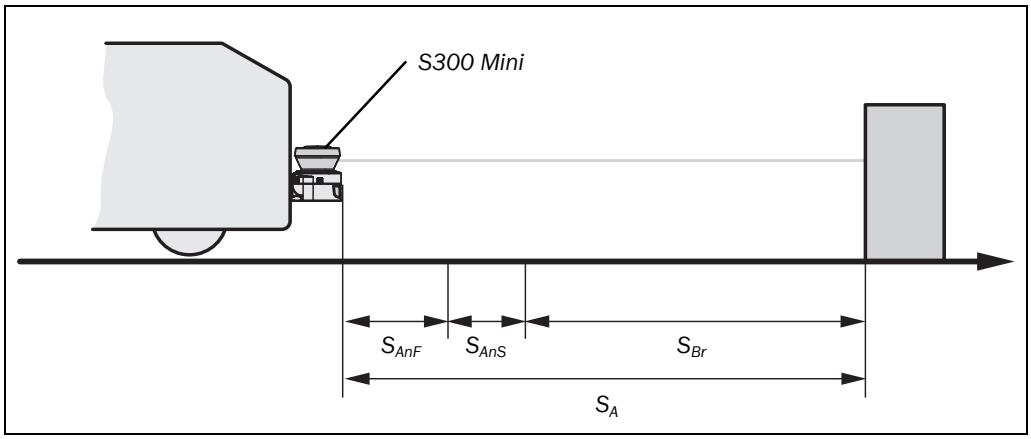
Where ...

S_A = Stopping distance
Z_G = General safety supplement of the S300 Mini = 100 mm
Z_R = Supplement for any reflection related measurement error of the S300 Mini
Z_F = Supplement for any lack of ground clearance of the vehicle
Z_B = Supplement for the reduction in the braking performance of the vehicle to be found in the related vehicle documentation

Stopping distance S_A

The stopping distance comprises the braking distance for the vehicle, the distance covered during the response time of the safety laser scanner and the response time of the vehicle controller.

Fig. 34: Stopping distance



Note Take into account that the braking distance for a vehicle is not linear with increasing velocity, but increases in a square function. This is particularly important if you switch between protective fields with different sizes dependant on the velocity monitored by use of incremental encoders.

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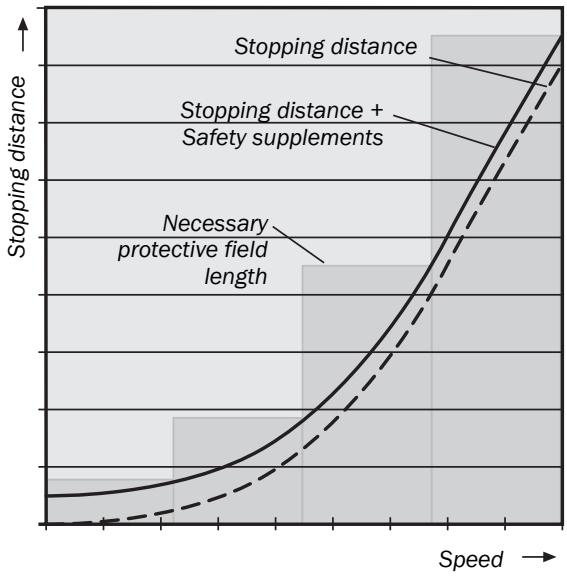
Fig. 35: Stopping distance as a function of the vehicle velocity



How to calculate the stopping distance S_A:

➢ Calculate the stopping distance S_A using the formula:

$S_A = S_{Br} + S_{AnF} + S_{AnS}$

Where ...

S_{Br} = Braking distance, to be found in the vehicle documentation

S_{AnF} = Distance covered during the response time of the vehicle controller, to be found in the vehicle documentation

S_{AnS} = Distance covered during the response time of the safety laser scanner

Distance covered during the response time of the safety laser scanner

The distance covered during the response time of the safety laser scanner depends on ...

- the response time of the safety laser scanner.
- the maximum velocity of the vehicle in your mobile application.

The response time T_S of the S300 Mini depends on ...

- the basic response time of the S300 Mini,
- the multiple sampling set,
- the transmission speed to external OSSDs via EFI.

See section 12.2 “OSSD response times” on page 106.

How to calculate the distance S_{AnS} covered during the response time of the safety laser scanner:

➢ Calculate the distance S_{AnS} using the formula:

$S_{AnS} = T_S \times V_{max}$

Where ...

T_S = Response time of the safety laser scanner

V_{max} = Maximum velocity of the vehicle from the related vehicle documentation

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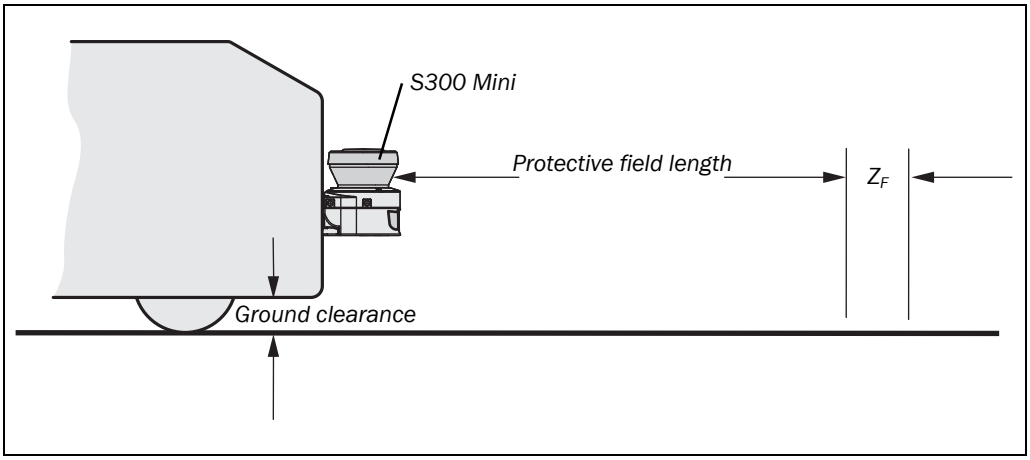
Supplement Z_R for measurement errors caused by reflection

With retroreflectors in the background at a distance of less than 1 m from the boundary of the protective field, the supplement Z_R is 200 mm.

Supplement Z_F due to lack of ground clearance

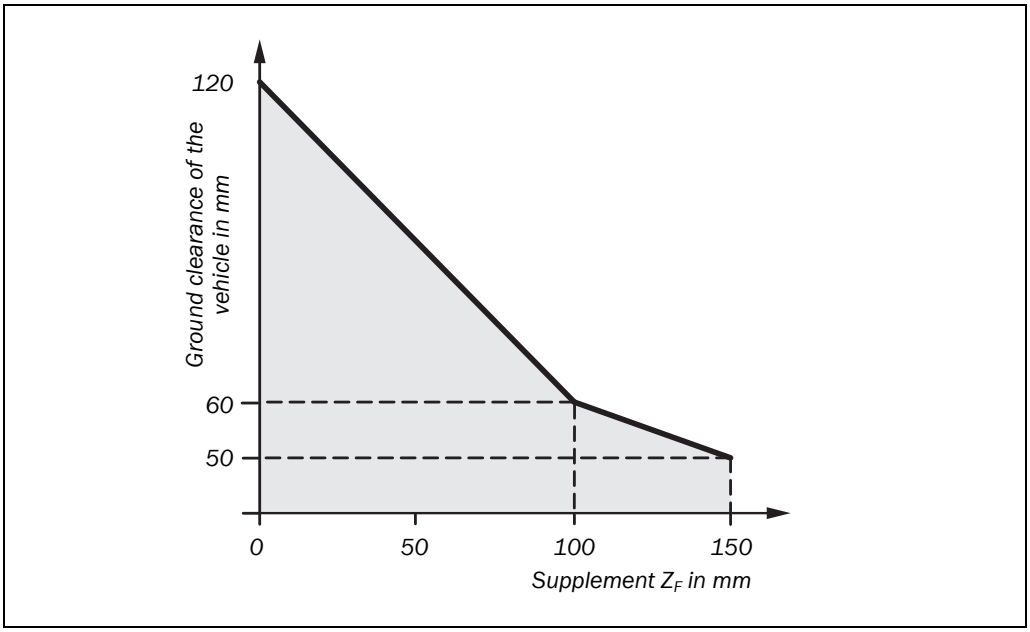
This supplement is necessary because a person is generally detected above the foot and the braking action can therefore not take into account the length of the foot in front of the detection point. If a vehicle has no ground clearance, a person may receive foot injuries.

Fig. 36: Supplement due to lack of ground clearance



➢ The flat rate supplement for ground clearance below 120 mm is 150 mm. This supplement can be further reduced in specific cases. For this purpose read off the actual supplement necessary for the ground clearance of your vehicle from the diagram below:

Fig. 37: Diagram of ground clearance of the vehicle



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5.4.2 Protective field width

The width of the protective field must cover the width of the vehicle and the supplements for the measurement error and the lack of ground clearance.

How to calculate the protective field width S_B (see EN ISO 13 855):

➢ Calculate the protective field width S_B using the formula:

$S_B = F_B + 2 \times (Z_G + Z_R + Z_F)$

Where ...

F_B = Vehicle width

Z_G = General safety supplement of the S300 Mini = 100 mm

Z_R = Supplement for any reflection related measurement error of the S300 Mini

Z_F = Supplement for any lack of ground clearance of the vehicle

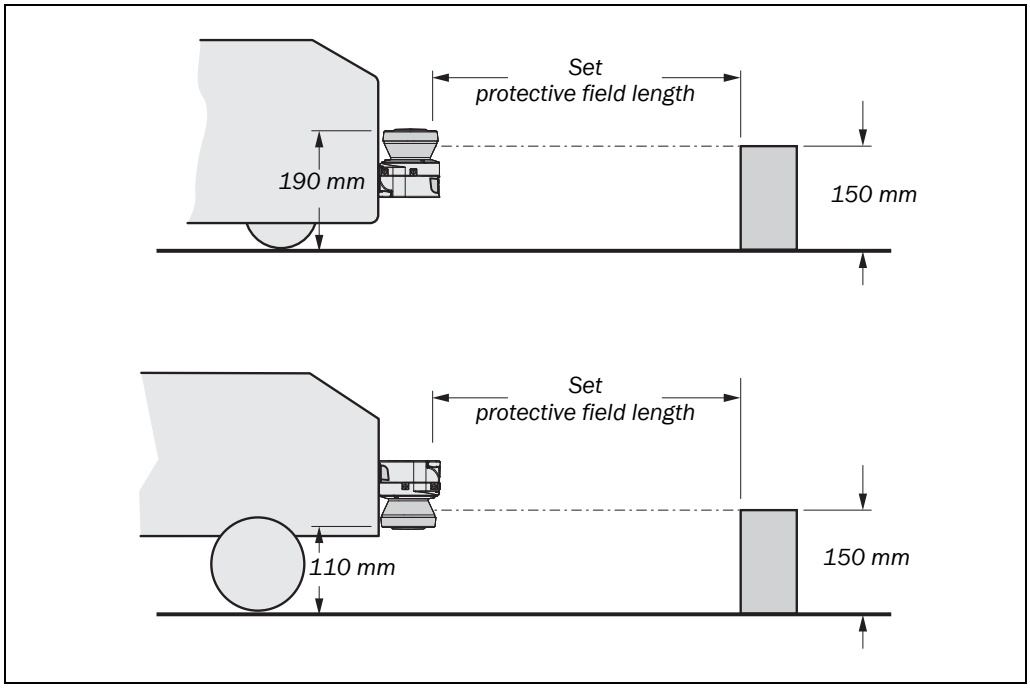
5.4.3 Height of the scan plane

WARNING

Mount the S300 Mini such that the scan plane is at a maximum height of 200 mm!

In this way also persons lying down will be reliably detected. Tilting the protective field so that objects with a diameter of 200 mm are not detected, is not allowed. We recommend aligning the scan plane horizontally at 150 mm.

Fig. 38: Mounting height



Note To produce the optimal scan plane, you can also mount the S300 Mini reversed.

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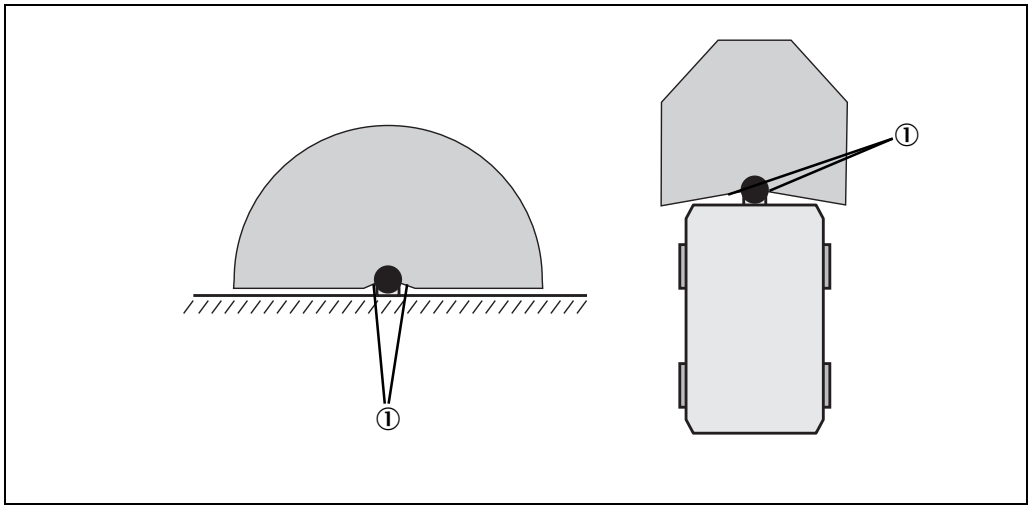
5.5 Methods of preventing unprotected areas

During mounting the S300 Mini, areas may be found that are not covered by the safety laser scanner (①).

Fig. 39: Unprotected areas

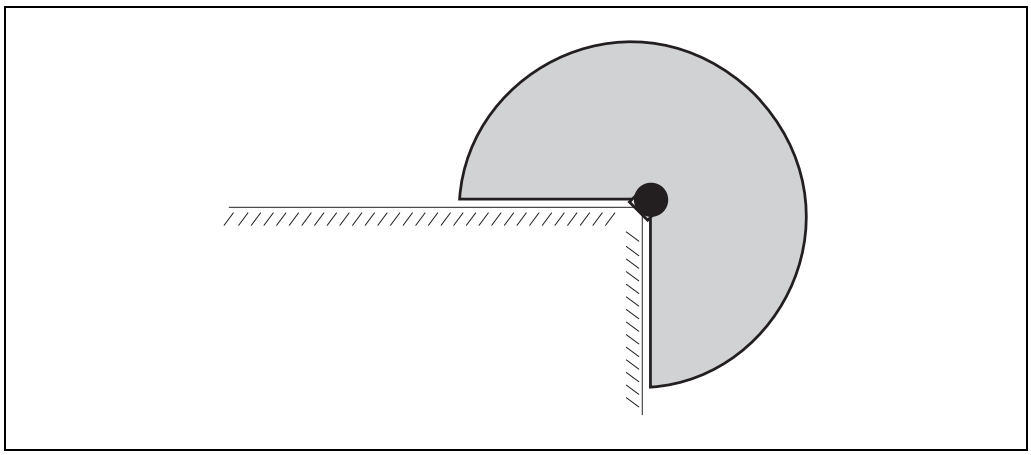


WARNING

Prevent or secure unprotected areas!

- Mount the S300 Mini such that there are no unprotected areas.
- For mobile applications, if the vehicle is accelerated to a maximum velocity of 0.3 m/s in less than three seconds when in operation, you must prevent personnel from entering the unprotected areas by means of mechanical trim panels, switch strips or fitting the S300 Mini in the vehicle trim panels.

Fig. 40: Preventing unprotected areas



Mount the S300 Mini for example on a corner to prevent unprotected areas.

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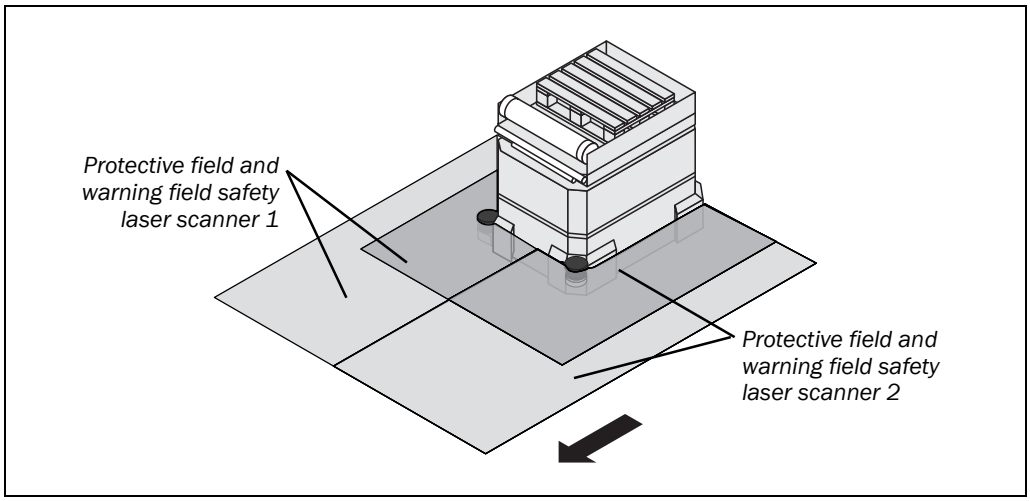
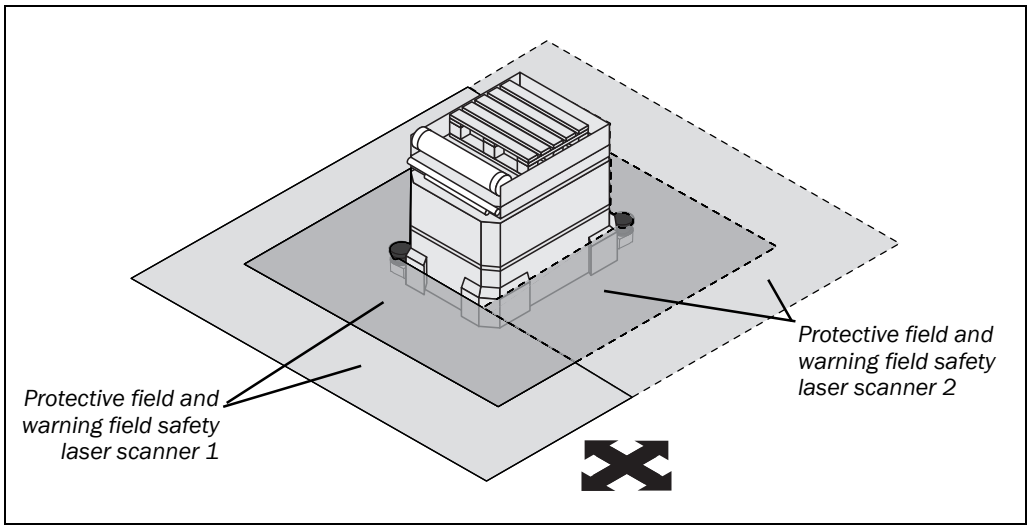
Fig. 41: Mounting example for front and side protection in a direction of travel



With two S300 Mini mounted at an angle of 45° on the front corners of a vehicle, you can configure the protective fields so that there are no unprotected areas and the hazardous areas in narrow aisles can also be protected.

Fig. 42: Mounting example for all-round protection in all directions of travel



With two S300 Mini mounted diagonally opposite, you can implement protective fields on the vehicle for all-round protection in all directions of travel.

5.5.1 Near range

Make the near range impassible using a bar or a recess, or additionally protect the near range (5 cm wide area in front of the optics cover) using a proximity switch with 5 cm acquisition range. The vehicle may then be accelerated as required.

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5.6 Time for monitoring case switching

If you switch between several monitoring cases, along with the minimum distance to the dangerous state there is a further safety relevant aspect that you must address.

WARNING

Set the timing for the switching such that the S300 Mini already detects a person in the protective field with an adequate minimum distance before the dangerous state occurs!

Note that at the time of the switching there may be a person in the protective field. Only by means of switching in the correct time frame (i.e. before the hazard occurs at this point for the person) is protection provided.

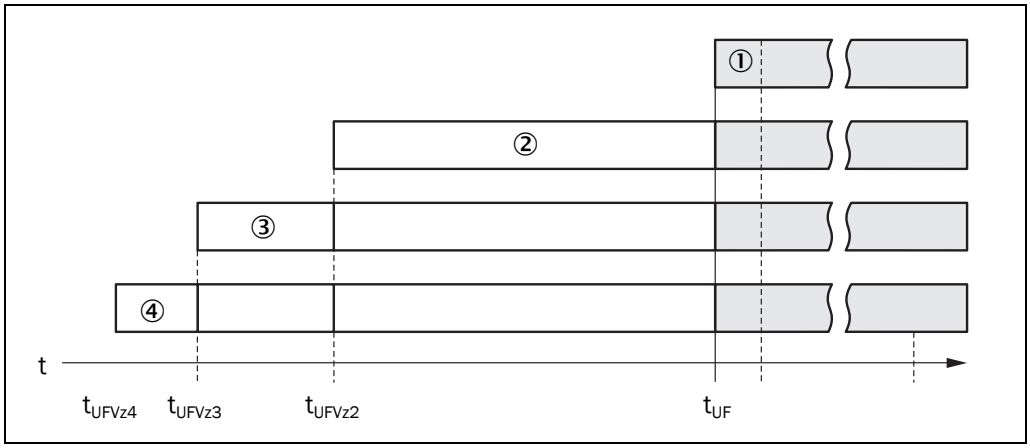
If you switch the controller within 10 ms, the protective field selected is available within the basic response time of the S300 Mini. For this reason you can initiate the switching at the time at which you actually want to switch from one monitoring case to the other.

However, you must advance the timing of the switching if you ...

- have entered an input delay for your switching method.
- use external inputs (e.g. the inputs of a Flexi Soft).
- control external OSSDs instead of the internal OSSDs (e.g. the OSSDs on another S3000 Expert) via EFI.

The following diagram shows the relationships:

Fig. 43: Advancement for the switch timing



- If the input conditions are present at the control inputs within 10 ms (cf. ①), the timing for the switching (t_{UF}) does not need to be advanced.
- If an input delay for the control inputs needs to be taken into account (cf. ②), the timing for the switching (t_{UFVz2}) must be advanced by the input delay.
- If the inputs on a different device are used via EFI, the timing for the switching (t_{UFVz3}) must be further advanced by 0.5 times the basic response time of the slowest system in the EFI system (cf. ③).
- If external OSSDs are used, the timing for the switching (t_{UFVz4}) must be further advanced by 20 ms (cf. ④).

Notes

- In the phases before and after the switching, the minimum distances calculated for the individual monitoring cases apply on their own.
- The considerations above serve only for the selection of the optimal timing of the switching.

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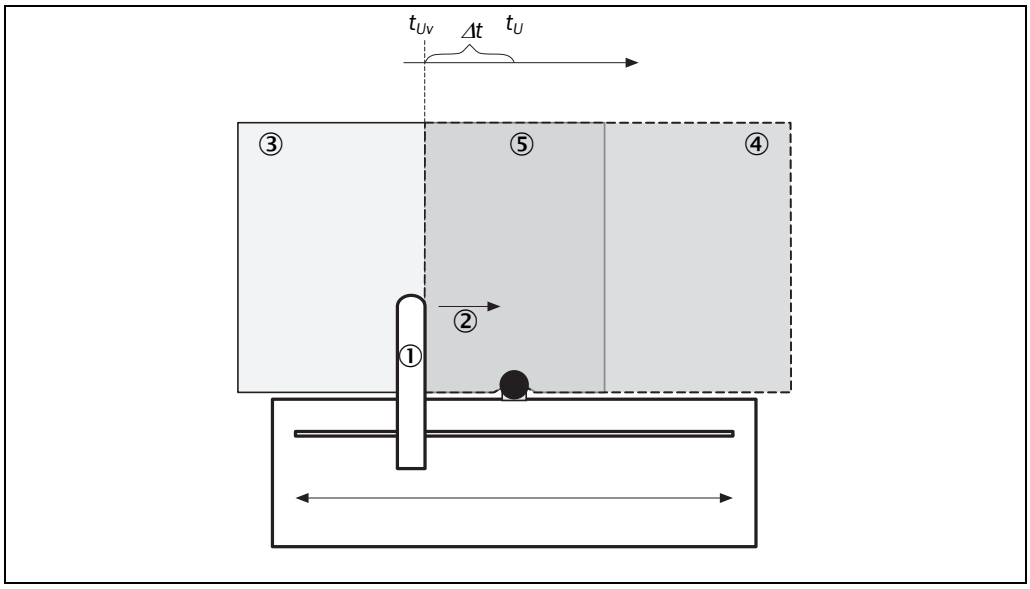
- If the timing for the switching cannot be exactly defined, e.g. due to the variable processing speed of the machine, or advancing the timing results in premature termination of the monitoring of the initial area, you must allow the two protective fields to partially overlap.

The following figure shows an example for a gantry robot that is protected using two monitoring cases.

Fig. 44: Example of advancing the timing for the switching



The gantry robot ① moves to the right ②. On the left hand side the dangerous movement is monitored by a monitoring case ③. When the gantry robot arrives at the point t_{Uv}, switching must have already been performed due to the advancing of the switching necessary so that at time t_U the right monitoring case ④ is active.

Notes

- For the movement to the left, that is for the switching to the monitoring case ③, the same applies.
- The protective fields for the monitoring cases must overlap here ⑤, so that a protective function is always provided.

How far you must advance the timing for the switching depends on ...

- the input delay required for the used switching method to provide the input condition for case switching (see section 4.3.1 “Input delay” on page 33).
- whether you use external OSSDs via EFI.
- whether you use external control inputs (e.g. the inputs of a Flexi Soft safety controller).

How to calculate the timing for the switching:

➢ Calculate the timing for the switching using the following formula:

$t_{UFVz} = t_{EVz} + t_{exOVz} + t_{StVz}$

Where ...

t_{UFVz} = Timing advance for the switching

t_{EVz} = Input delay for the control inputs

t_{exOVz} = Delay due to external OSSDs over EFI = 20 ms

t_{StVz} = Delay due to external control inputs over EFI (0.5 × basic response time of the slowest system in the EFI system)

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Subject to change without notice

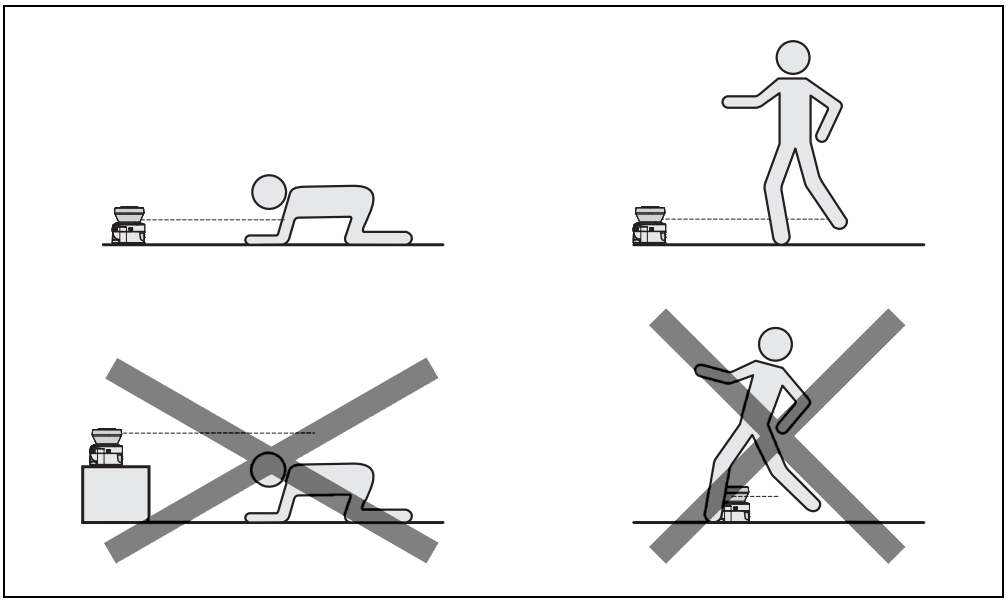
5.7 Mounting steps

WARNING

Special features to note during mounting:

- Mount the S300 Mini such that it is protected from moisture, dirt and damage.
- Ensure that the entire field of view of the S300 Mini is not restricted.
- Mount the safety laser scanner such that the indicators are easy to see.
- Avoid excessive shock and vibration loading on the safety laser scanner.
- On systems that suffer from heavy vibration, prevent the fixing screws from coming loose using screw locking devices.
- Regularly check the tightness of the fixing screws.
- Prevent personnel from being able to crawl beneath, stand behind or climb over the protective field by means of appropriate mounting of the S300 Mini.

Fig. 45: Prevent crawling beneath, standing behind, climbing over



The origin of the scan plane is 80 mm above the bottom edge of the S300 Mini (see Fig. 78 on page 117).

There are three possible ways of fixing the S300 Mini:

- direct mounting without mounting kit
- mounting with mounting kit 1a or 1b
- mounting with mounting kit 2 (only in conjunction with mounting kit 1a or 1b)

You will find the part numbers for the mounting kits in section 13.3.1 “Mounting kits” on page 121.

Note Pay attention to the maximum tightening torque of the M5 fixing screws on the S300 Mini of max. 5.9 Nm.

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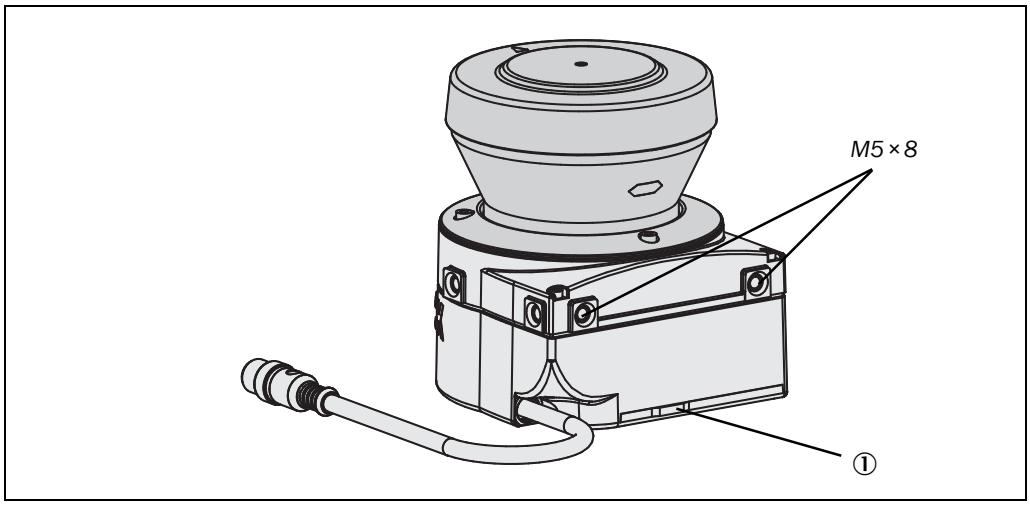
5.7.1 Direct mounting

The S300 Mini has two threaded holes M5 × 8 on the rear. Using them you can mount the S300 Mini directly on the intended mounting surface. To avoid a possible tendency to vibrate, if necessary the reference surface on the rear can be used as the third mounting point ①.

Fig. 46: Direct mounting

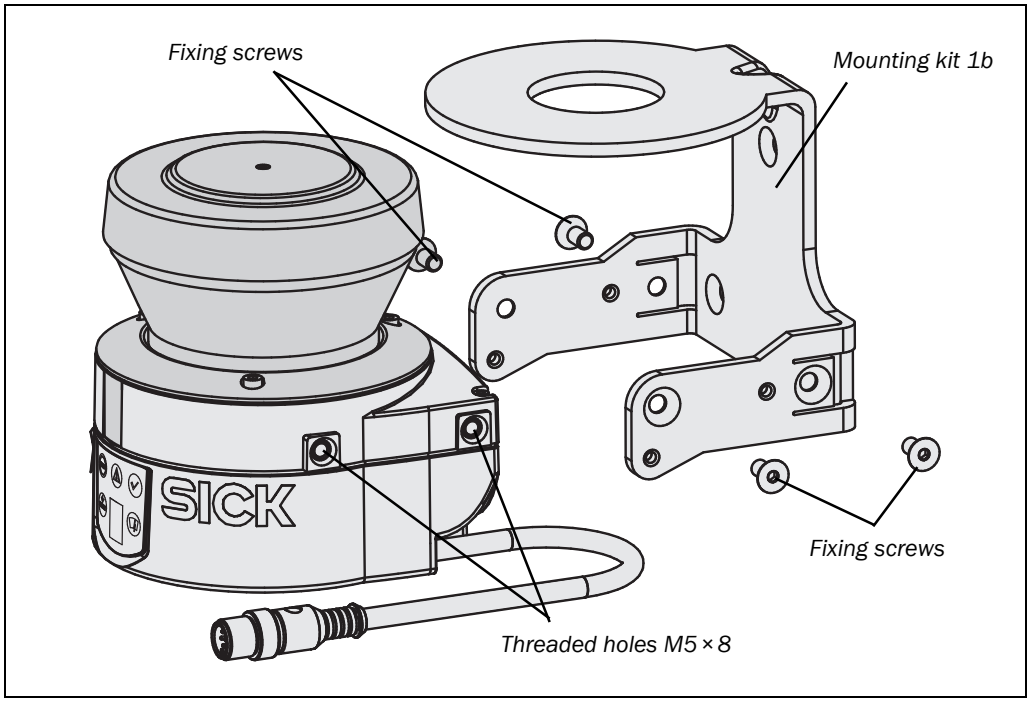


Notes During mounting, please observe the dimensional drawings (see section 12.6 “Dimensional drawings” on page 117).

5.7.2 Mounting with mounting kit 1a or 1b

With the aid of mounting kit 1 you can mount the S300 Mini indirectly on the mounting surface. The mounting kit is available as mounting kit 1a without protection device for the optics cover and as mounting kit 1b with protection device for the optics cover.

Fig. 47: Mounting with mounting kit 1b incl. protection for the optics cover



➢ Mount mounting kit 1a or 1b on the mounting surface.

➢ Then mount the S300 Mini on the mounting kit 1a or 1b.

Note During mounting, please observe the dimensional drawings (see section 12.6 “Dimensional drawings” on page 117).

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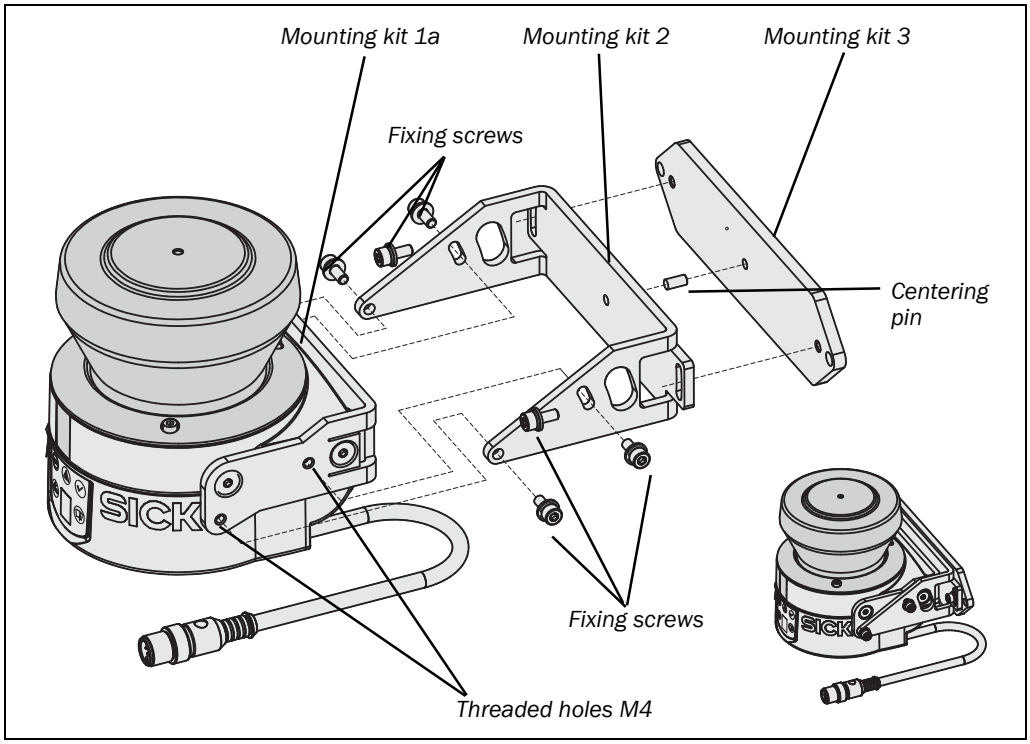
5.7.3 Mounting with mounting kit 2 and 3

With the aid of mounting kits 2 and 3 (only in conjunction with mounting kit 1a or 1b) you can align the S300 Mini in two planes. The maximum adjustment angle is ±11° in both planes.

Fig. 48: Mounting with mounting kit 2



- Mount mounting kit 1a or 1b to the S300 Mini.
- Mount the mounting kit 3 on the mounting surface.
- Fit the centering pin (4 mm) in the central hole on mounting bracket 3.
- Fit mounting kit 2 to mounting kit 3 and mount it using two fixing screws M4 × 10.
- Then mount the S300 Mini on mounting kit 2 with the aid of the threaded holes in mounting kit 1a.
- Adjust the S300 Mini longitudinally and transversely and then tighten the six fixing screws on the mounting kits.

Note During mounting, please observe the dimensional drawings (see section 12.6 “Dimensional drawings” on page 117).

5.7.4 Information label Important information

- On completion of mounting, you must affix the self-adhesive information label **Important information** supplied:
  - Use only the information label in the language which the operators of the machine can read and understand.
  - Place the information label such that it is clearly visible for the operators during operation. The information label must not be covered even after additional items have been mounted.

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5.7.5 Using multiple S300 Mini safety laser scanners

The S300 Mini is so designed that mutual interference between several safety laser scanners is unlikely. To completely exclude erroneous switching, you must mount the safety laser scanners as shown in the following examples.

Note In any circumstance observe EN ISO 13855 when calculating the minimum distance.

Use mounting kits 1 and 2 to adjust the safety laser scanners to different angles (see section 13.3.1 “Mounting kits” on page 121).

Fig. 49: Opposite mounting

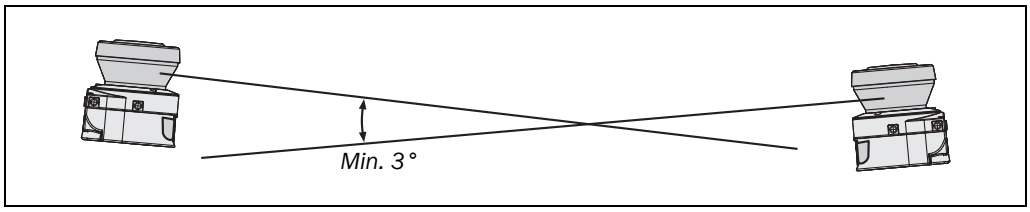

Fig. 50: Offset parallel mounting

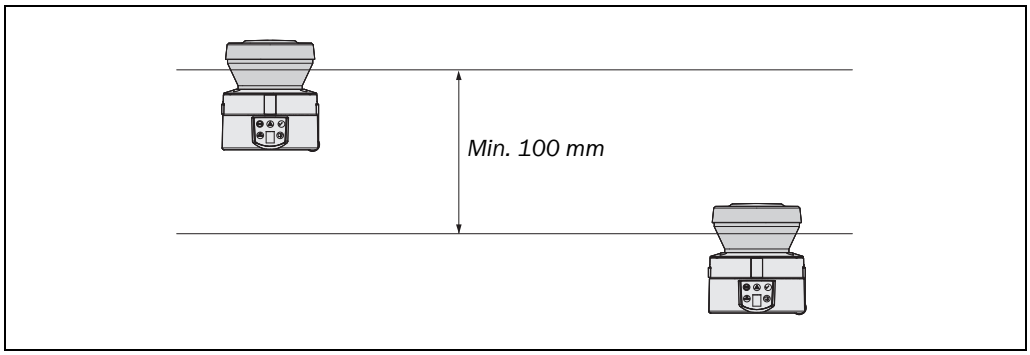

Fig. 51: Mounting on a cross

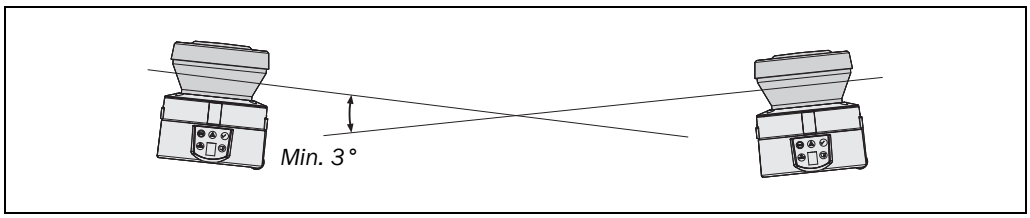

Fig. 52: Reverse mounting, parallel offset

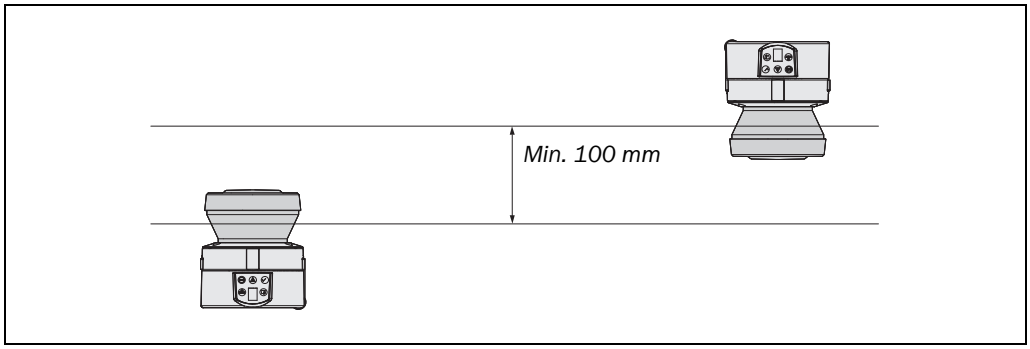

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Fig. 53: Reverse mounting of two S300 Mini, with parallel offset

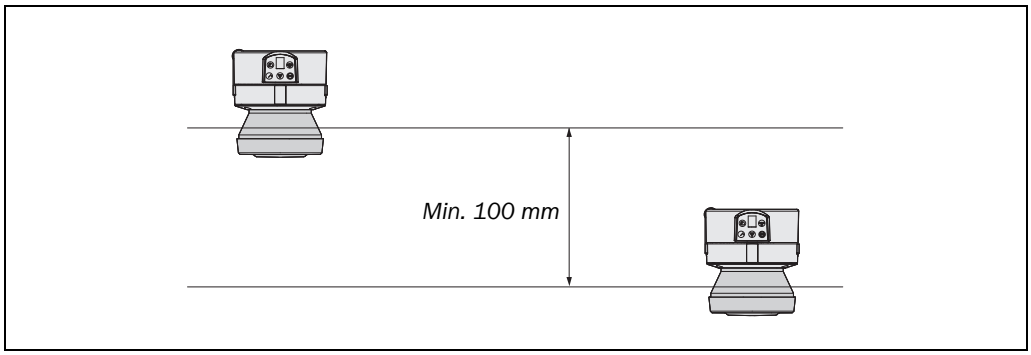
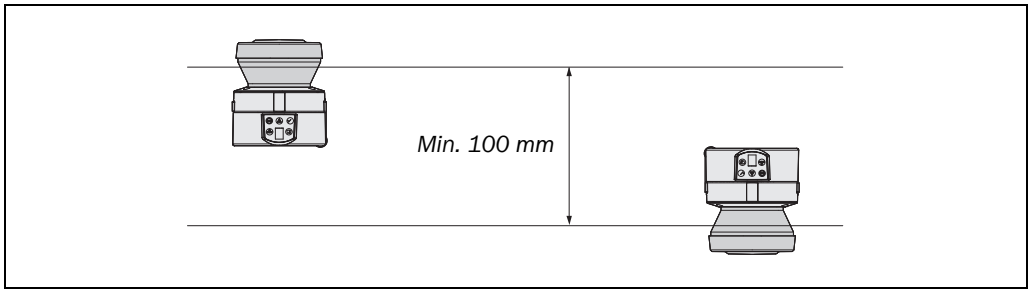


Fig. 54: Reverse mounting of an S300 Mini, with parallel offset



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6 Electrical installation

WARNING

Switch the entire machine/system off line!

The machine/system could unintentionally start up while you are connecting the devices.

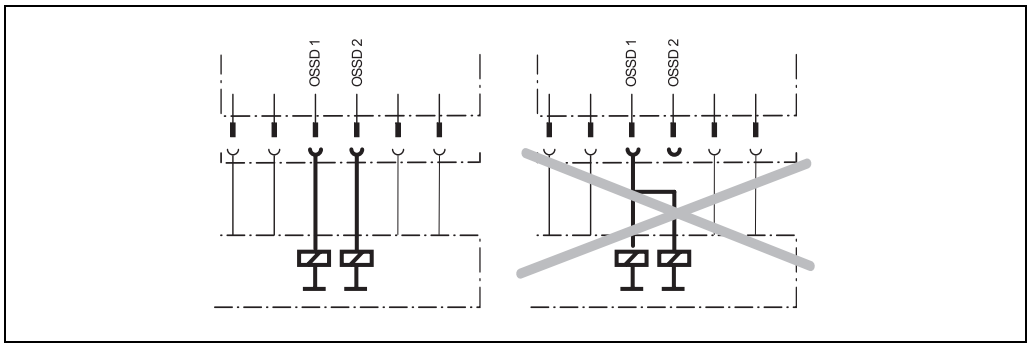
➢ Ensure that the entire machine/system is disconnected during the electrical installation.

Connect OSSD1 and OSSD2 separately!

You are not allowed to connect OSSD1 and OSSD2 together, otherwise signal safety will not be ensured.

➢ Ensure that the machine controller processes the two signals separately.

Downstream contactors must be positively guided and monitored.



Only ever connect one downstream switching element to an OSSD!

Each output signal switching device (OSSD) is only allowed to be connected to one switching element (e.g. relay or contactor). If several switching elements are required, you must choose a suitable form of contact duplication.

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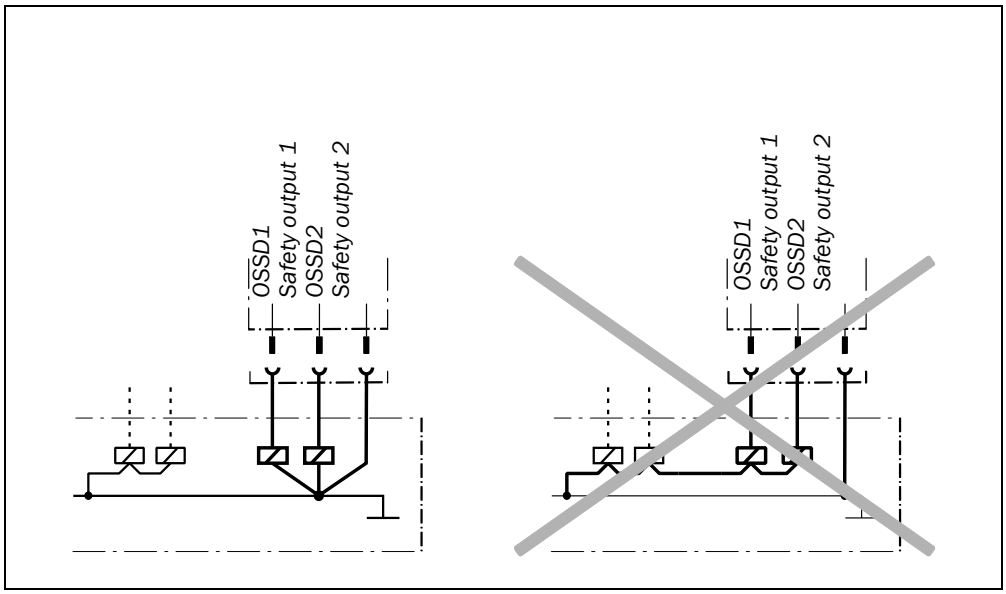
Prevent the occurrence of a potential difference between the load and the protective device!

- If you connect loads that are not reverse-polarity protected to the OSSDs or the safety outputs, you must connect the 0 V connections of these loads and those of the corresponding protective device individually and directly to the same 0 V terminal strip. This is the only way to ensure that, in the event of a defect, there can be no potential difference between the 0 V connections of the loads and those of the corresponding protective device.



Notes

- Route all cables and connection cables such that they are protected from damage.
- Ensure that also the controller connected and all devices related to safety have the required category as per EN ISO 13849-1 or the required performance level as per EN ISO 13849-1!
- If you use screened cables, lay the screen evenly around the connection terminal.
- Ensure that the S300 Mini is adequately protected electrically. You will find the electrical data necessary for determining the correct fuse in section 12.4 “Data sheet” on page 110.

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6.1 System connection

You will find all the inputs and outputs on the S300 Mini on the round plug connector on the connecting cable. Connect the S300 Mini using pre-assembled extension cables (see Tab. 19 on page 80 and Tab. 21 on page 81).

The pin assignments for the round plug connector vary depending on the S300 Mini variant.

Notes

- All inputs and outputs on the S300 Mini are to be used only in the context specified.
- The round plug connectors are coded. If you use plug connectors other than the connectors intended, any claims against SICK AG under the warranty will be rendered void.

Wiring in accordance with EMC regulations

The quality of the shield is essentially dependent on the quality of the connection of the screen. In principle the best screening action can only be achieved with the connection of the screen at both ends using large area connections.

➢ If it is not possible to connect the screen via threaded fittings (e.g. on bus nodes), connect the screen physically close, e.g. to a control cabinet chassis using a metal clamp.

Notes

- If you want to operate two safety laser scanners in a system (communication via EFI), then the same earthing method must be used for both safety laser scanners.
- If there is a PE in an installation, it can be used for the connection of the FE. However a functional earth connection (FE) is never allowed to be used as a PE!

Functional earth

To achieve the specified EMC safety, the functional earth FE must be connected (e.g. to the vehicle's or system's central earth star point).

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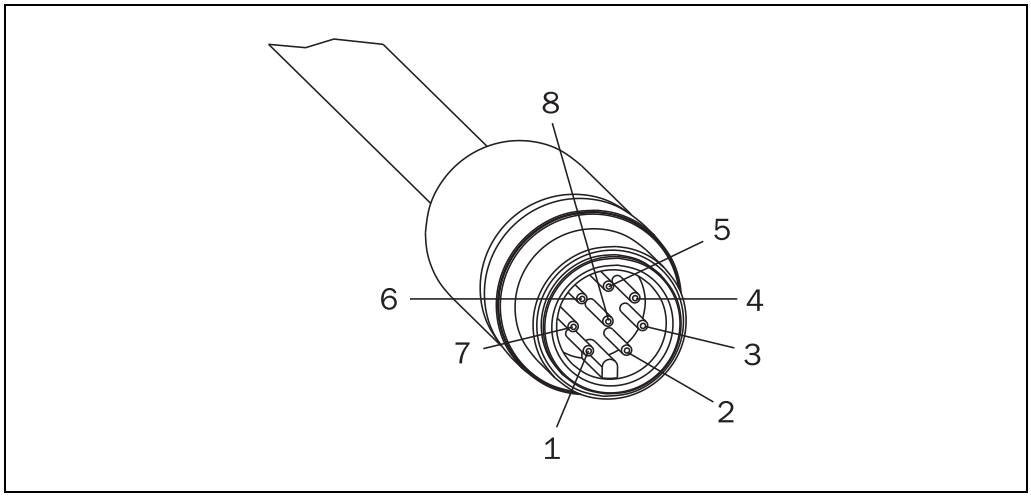
6.1.1 Round plug connector S300 Mini Standard

Fig. 55: Round plug connector S300 Mini Standard



Pin assignment of the S300 Mini Standard

Tab. 18: Pin assignment of the S300 Mini Standard

Pin	Signal	Function
1	WF	Output for warning field 1
2	+24 V DC	Supply voltage S300 Mini
3	I/O1	Universal I/O
4	I/O2	Universal I/O
5	OSSD1	Output signal switching device
6	OSSD2	Output signal switching device
7	0 V DC	Supply voltage
8	FE/screen	Functional earth/screen
Housing	FE/screen	Functional earth/screen

Use the extension cables with A-coding listed in Tab. 35 on page 122 to connect the S300 Mini Standard.

Core assignment of the S300 Mini Standard extension cable

Tab. 19: Core assignment of the S300 Mini Standard extension cable

Core	Color	Function
1	White	Output for warning field 1
2	Brown	Supply voltage 24 V DC
3	Green	Universal I/O connection 1
4	Yellow	Universal I/O connection 2
5	Gray	Output signal switching device OSSD1
6	Pink	Output signal switching device OSSD2
7	Blue	Supply voltage 0 V DC
8	FE/screen	Functional earth/shield

Universal I/O connections of the S300 Mini Standard

WARNING

Do not use the universal I/O connection outputs for safety-related tasks!

The universal I/O connection outputs are purely application diagnostics outputs, e.g. for the transfer of information to controllers.

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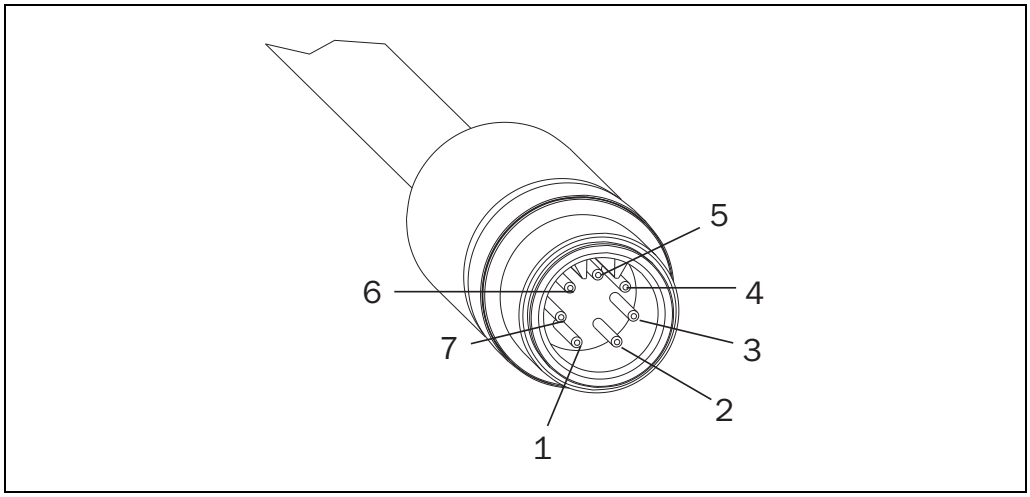
6.1.2 Round plug connector S300 Mini Remote

Fig. 56: Round plug connector S300 Mini Remote



Pin assignment of the S300 Mini Remote

Tab. 20: Pin assignment of the S300 Mini Remote

Pin	Signal	Function
1[9)]	H/G	Host/guest input
2	+24 V DC	Supply voltage S300 Mini
3	–	Not assigned
4	–	Not assigned
5	EFI_B	Enhanced function interface
6	EFI_A	Enhanced function interface
7	0 V DC	Supply voltage
Housing	FE/screen	Functional earth/screen

Note To meet the EMC requirements, on the S300 Mini Remote a specially screened connecting cable must be used. For this purpose you must use the extension cables with a special coding listed in Tab. 36 on page 122. You can identify these from the blue plug insert. If you use plug connectors other than the connectors intended, any claims against SICK AG under the warranty will be rendered void.

Core assignment of the S300 Mini Remote extension cable

Tab. 21: Core assignment of the S300 Mini Remote extension cable

Core	Color	Function
1	White	Host/guest input
2	Brown	Supply voltage 24 V DC
3	Green	Not assigned
4	Yellow	Not assigned
5	Gray	Enhanced function interface EFI_B
6	Pink	Enhanced function interface EFI_A
7	Blue	Supply voltage 0 V DC
Screen	FE/screen	Functional earth/screen

9) For the unambiguous identification of the S300 Mini in the EFI network (see section 3.5 on page 24).

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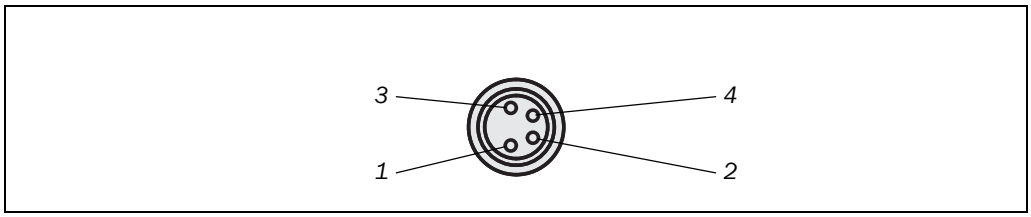
6.2 Configuration connection M8 × 4 (serial interface)

Fig. 57: Pin assignment configuration connection M8 × 4



Tab. 22: Pin assignment configuration connection M8 × 4

Pin	S300 Mini	PC-side RS-232-D-Sub
1	Reserved	Not assigned
2	RxD	Pin 3
3	0 V DC (voltage supply)	Pin 5
4	TxD	Pin 2

Notes

- After configuration always remove the connecting cable from the configuration connection!
- After the configuration of the device has been completed, locate the attached protection cap to cover the configuration connection.

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7 Application examples and connection diagrams

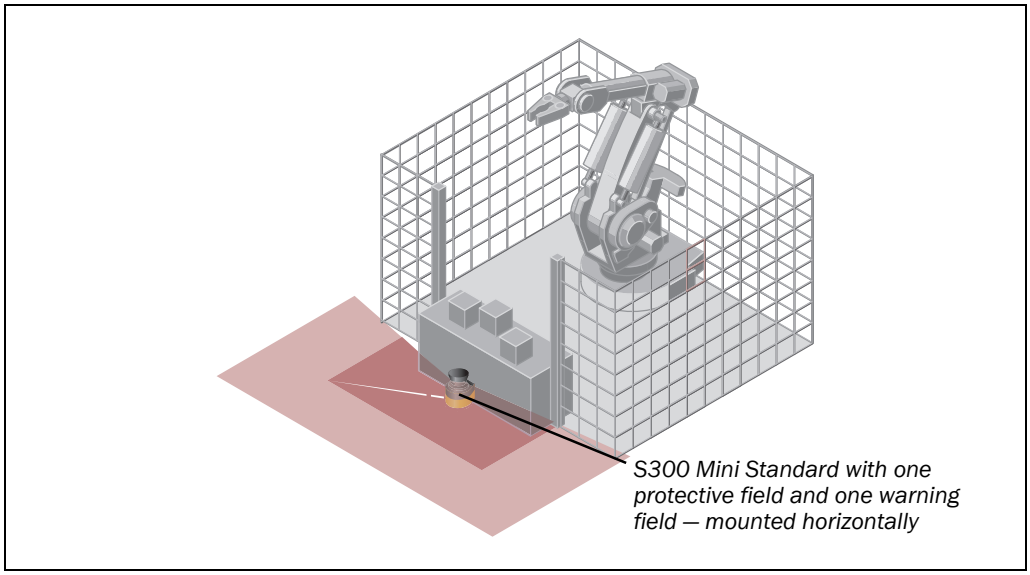
The examples shown are only provided as an aid for your planning. You may need to consider additional protection measures for your application.

In the examples with protective field switching, note that at the time of the switching there may already be a person in the protective field. Only by means of switching in the correct time frame (i.e. before the danger occurs at this point) is reliable protection provided (see section 5.6 “Time for monitoring case switching” on page 70).

7.1 Stationary applications

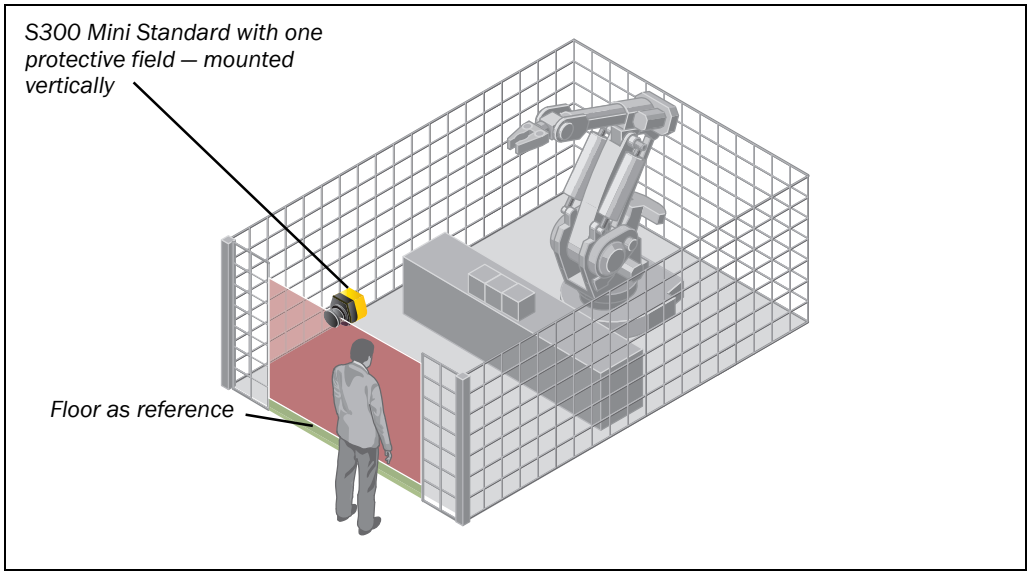
7.1.1 Applications with one monitored area (S300 Mini Standard)

Fig. 58: Hazardous area protection with S300 Mini Standard



The area is permanently monitored by the S300 Mini.

Fig. 59: Access protection with S300 Mini Standard



The access is monitored permanently. For safety against manipulation on the S300 Mini, e.g. the floor is used as a reference. If the alignment of the S300 Mini changes (e.g. due to changes to the bracket), the S300 Mini switches its OSSDs to the OFF state.

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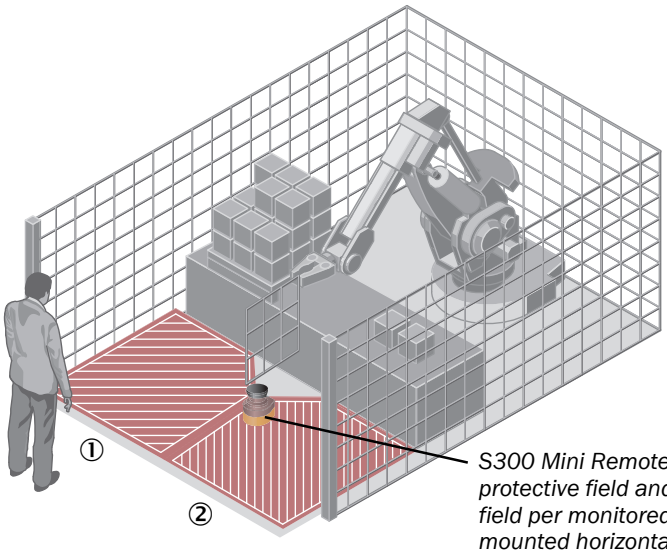
7.1.2 Applications with multiple monitored areas (S300 Mini Remote)

Fig. 60: Hazardous area protection with S300 Mini Remote



The two areas to be monitored are switched using the static control inputs depending on the phase of the process on the machine. For example the area ① or the area ② can be monitored.

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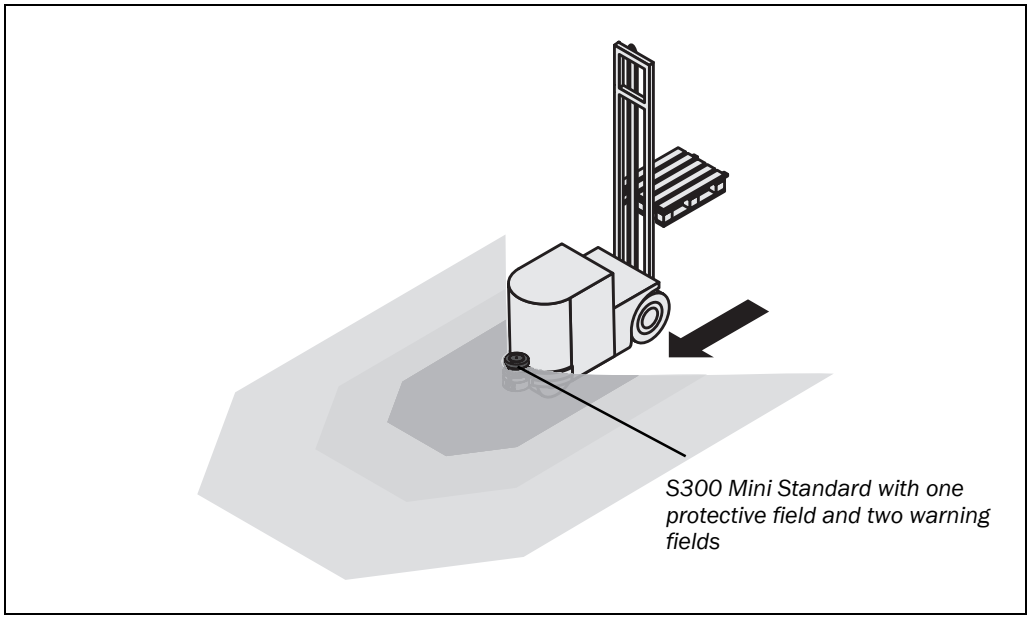
7.2 Mobile applications

7.2.1 Vehicle monitoring for unidirectional travel (S300 Mini Standard)

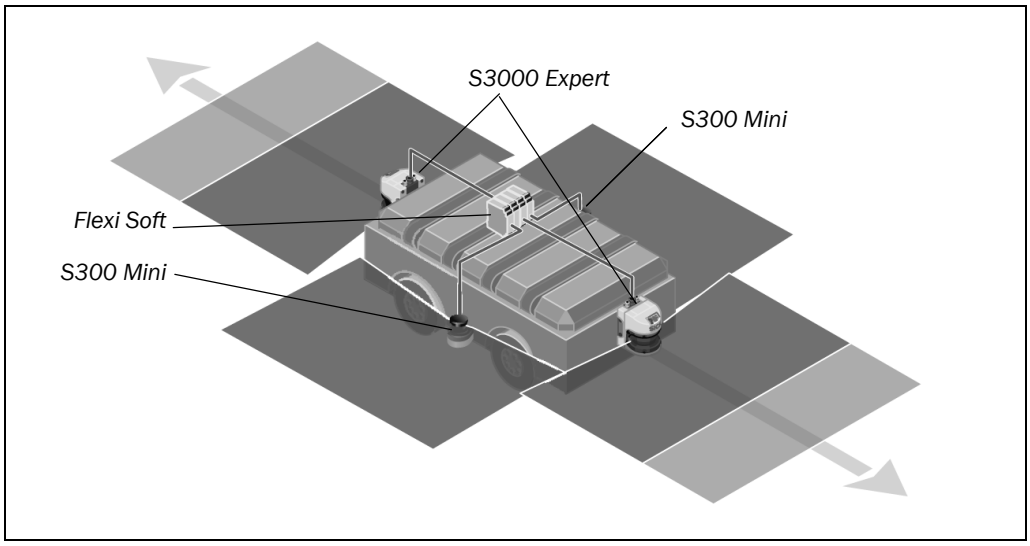
Fig. 61: Vehicle monitoring with S300 Mini Standard



The S300 Mini monitors the area in the direction of travel and switches its OSSDs to the OFF state to stop the vehicle as soon as there is an object in the protective field.

7.2.2 Vehicle monitoring with four safety laser scanners and the Flexi Soft modular safety controller

Fig. 62: Mobile application with S300 Mini and S3000 Expert



The protective fields on the two S3000 monitor in the related direction of travel on forward or reverse movement. The protective fields on the two S300 Mini monitor the area to the side of the vehicle. The information on the protective fields is passed via EFI to the Flexi Soft safety controller and there combined using logic modules.

The signal on the safety outputs on the Flexi Soft safety controller is passed to the vehicle control.

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7.3 Connection diagrams

Notes

- Only use relays/contacts with positively guided contacts. The protection elements connected in parallel with the relays/contactors are used for arc-suppression.
- Ensure that there is adequate arc-suppression at the relays/contactors. Take into account that arc-suppressors may lengthen the response time.
- The arc-suppressors must be in parallel with the relays/contactors (not across the contacts).
- If you want to operate two safety laser scanners in a system (communication via EFI), then the same earthing method must be used for both safety laser scanners.

Sketch key

- k1 and k2 or k3 and k4 = output circuits
  These contacts are to be connected to the controller such that, with the output circuit open, the dangerous state is disabled. For categories 3 and 4 according to EN ISO 13849-1, the integration must be dual-channel (x/y paths). Observe the maximum values for the loading of the outputs (see section 12.4 “Data sheet” on page 110).
- FE = functional earth
  To achieve the specified EMC safety, the functional earth (FE) must be connected (e.g. to the vehicle’s or system’s central earth star point).
- Hx = control switch, e.g. for Reset required or Error/contamination
- Sx = control switches, e.g. for resetting or encoders for monitoring case switching

7.3.1 S300 Mini Standard with restart interlock and external device monitoring

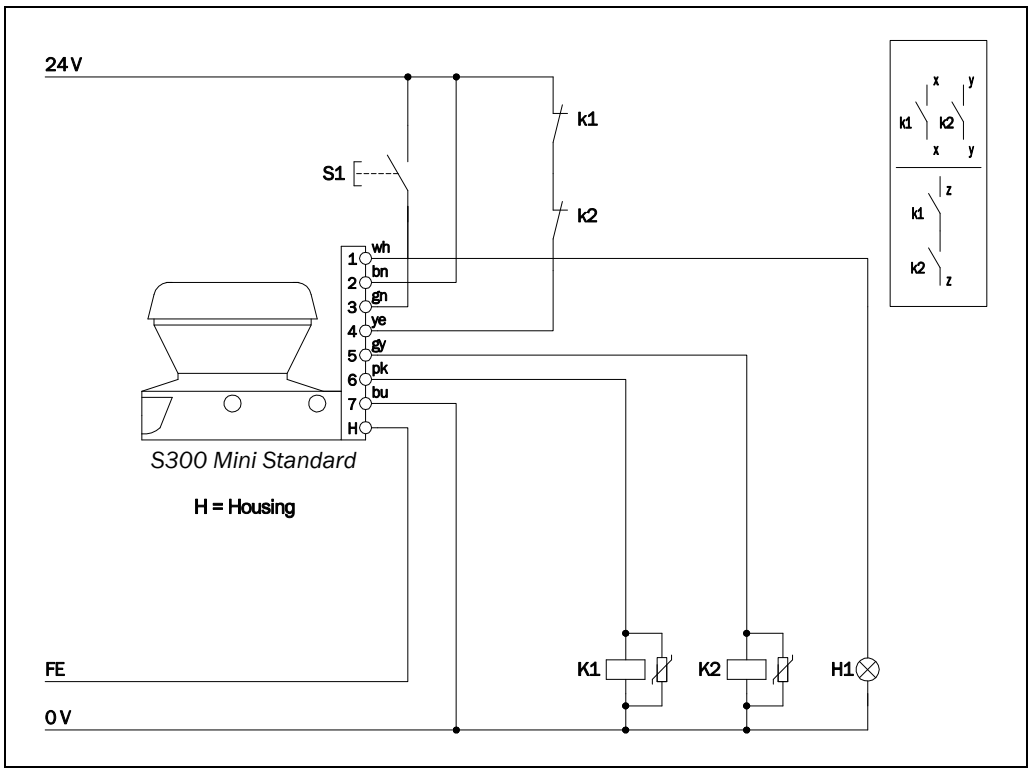

Fig. 63: Connection diagram for S300 Mini Standard with restart interlock and external device monitoring

S300 Mini Standard in conjunction with relays/contactors; operating mode: with restart interlock (universal I/O 1 must be configured as reset) and external device monitoring (universal I/O 2 must be configured as EDM).

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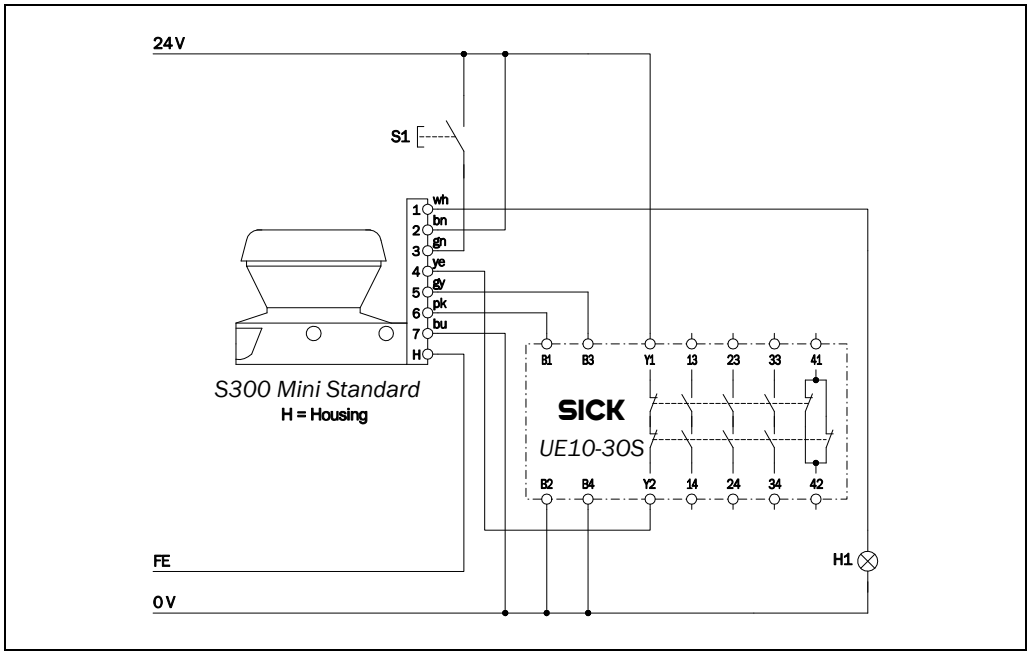
7.3.2 S300 Mini Standard in combination with a UE10 safety relay

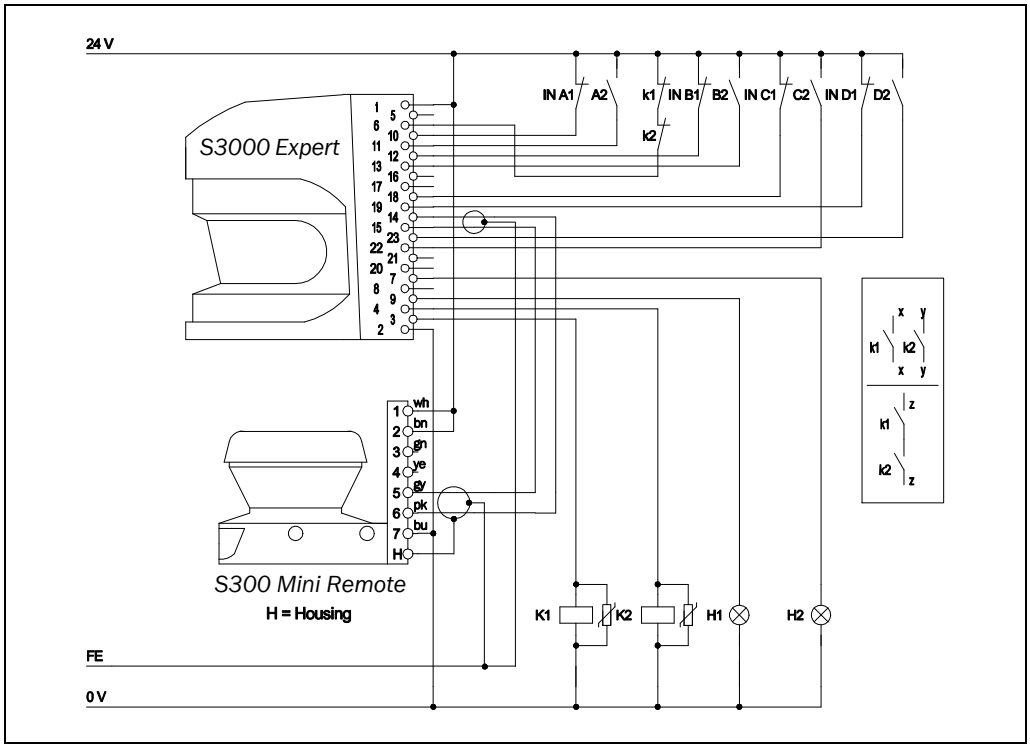
Fig. 64: Connection diagram for S300 Mini Standard in combination with a safety relay UE10



S300 Mini Standard in combination with a UE10 safety relay; operating mode: with restart interlock (universal I/O 1 must be configured as reset) and external device monitoring (universal I/O 2 must be configured as EDM).

7.3.3 Protective field switching between an S3000 Expert and an S300 Mini Remote with static inputs

Fig. 65: Connection diagram for protective field switching between an S3000 Expert and an S300 Mini Remote with static inputs



S3000 Expert with S300 Mini Remote in an EFI system with relays/contactors; operating mode: without restart interlock with external device monitoring; static protective field switching using the control inputs IN A to D of the S3000. The protective fields affect the OSSDs on the S3000 Expert.

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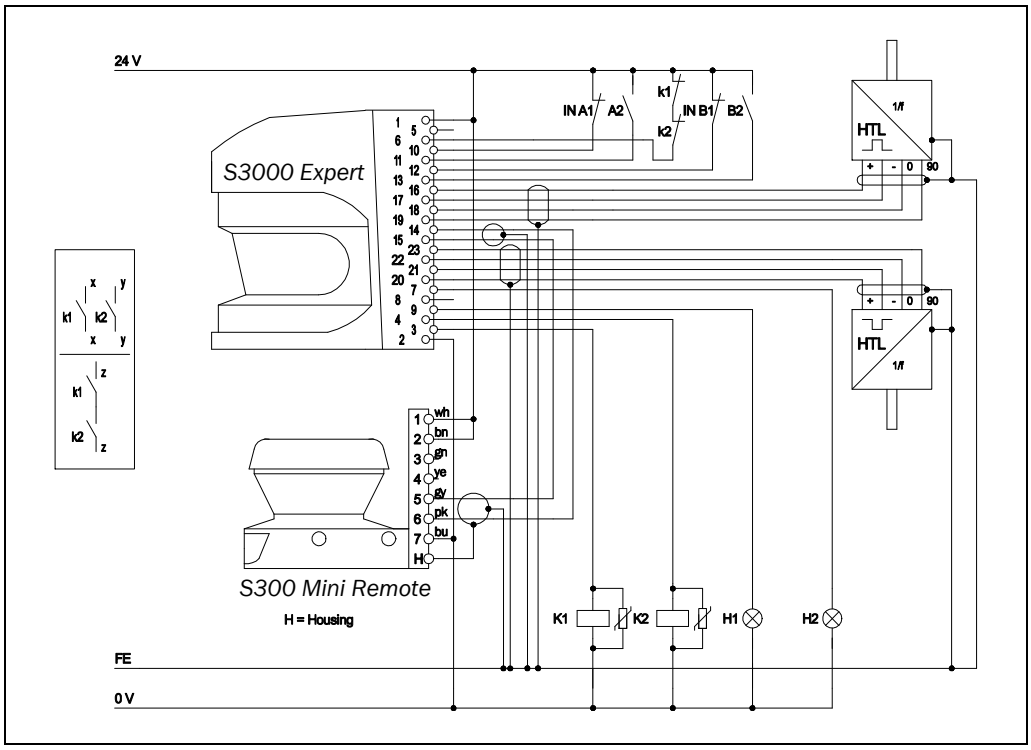
7.3.4 Protective field switching between an S3000 Expert and an S300 Mini Remote with static and dynamic inputs

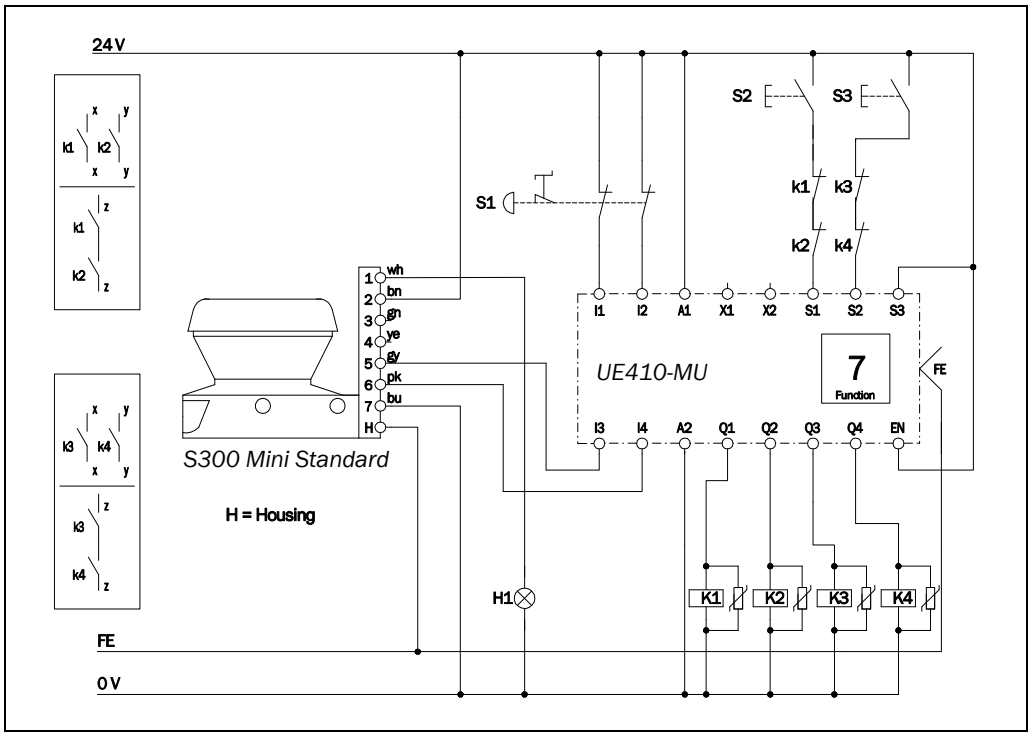
Fig. 66: Connection diagram for protective field switching between an S3000 Expert and an S300 Mini Remote with static and dynamic inputs



S3000 Expert with S300 Mini Remote in an EFI system with relays/contactors; operating mode: without restart interlock with external device monitoring; direction of travel dependent dynamic protective field switching by the incremental encoders as well as static protective field switching by the control inputs IN A and IN B on the S3000 Expert. The protective fields affect the OSSDs on the S3000 Expert.

7.3.5 Protective field switching using a Flexi Classic safety controller

Fig. 67: Connection diagram for S300 Mini Standard in combination with a Flexi Classic safety controller



One S300 Mini Standard; Protective field evaluation using a Flexi Classic safety controller.

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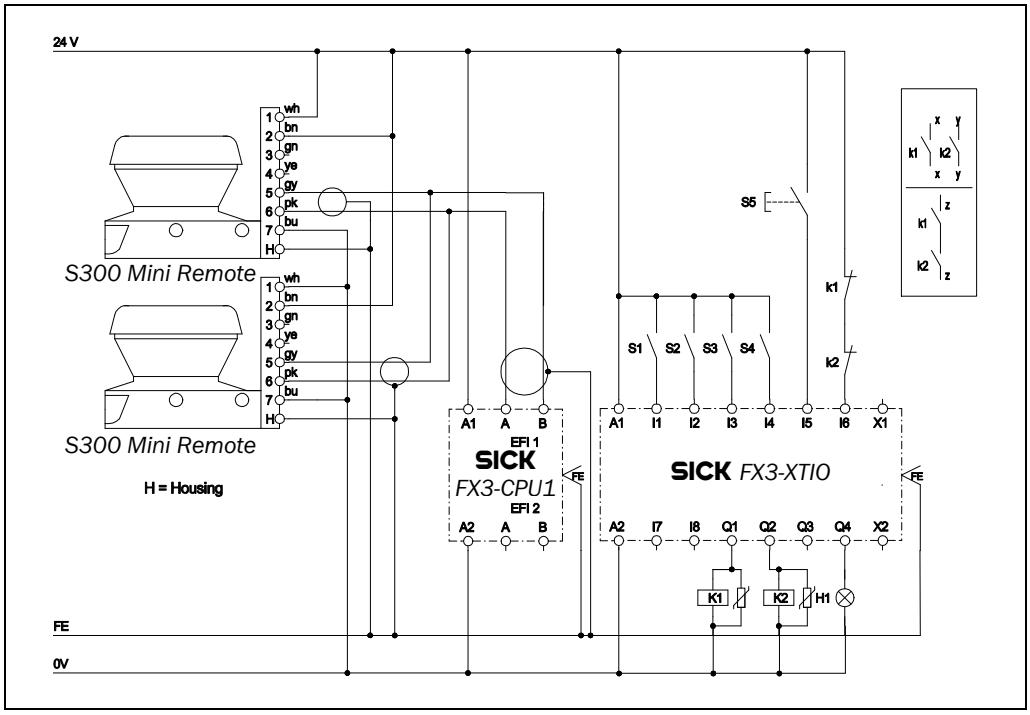
7.3.6 Protective field switching with a Flexi Soft safety controller

Fig. 68: Connection diagram for protective field switching for two S300 Mini Remote using a Flexi Soft safety controller



Two S300 Mini Remote; Protective field evaluation and switching via EFI using a Flexi Soft safety controller.

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8 Configuration

8.1 Default delivery status

The S300 Mini is delivered in a non-configured default state.

- The operational status is **Waiting for configuration**.
- The 7-segment display indicates 6.
  - On the S300 Mini Standard the output signal switching devices (OSSDs) are in the OFF state, the red LED is illuminated: ⊜.
  - On the S300 Mini Remote a protective field infringement is signaled via EFI, the red LED is illuminated: ⊜.

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8.2 Preparation of the configuration

How to prepare the configuration:

➢ Make sure that the safety laser scanner has been correctly mounted and that the electrical connections are correct and in place.

➢ Have the necessary tools at hand.

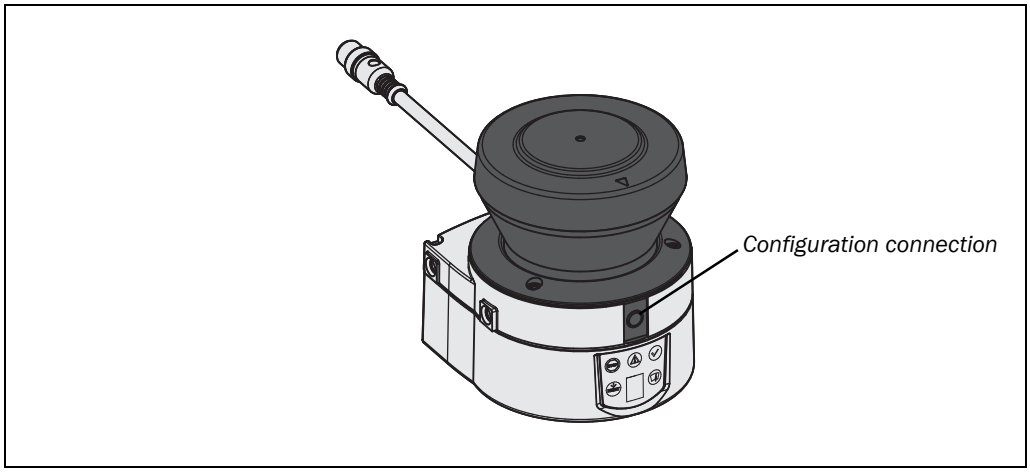
To configure the safety laser scanner you need:

- CDS (Configuration & Diagnostic Software) on CD-ROM, version 3.6.7 or higher
- user manual for CDS on CD-ROM
- PC/notebook with Windows NT 4/2000 Professional/XP/Vista/7 (32 Bit) and a serial RS-232 interface (PC/notebook not included)
- service cable for connecting PC and S300 Mini or Flexi Soft (not included)

How to configure the S300 Mini with the aid of the CDS:

To configure and perform diagnostics on the S300 Mini Remote connect the PC to the configuration connection on the Flexi Soft safety controller, the related EFI partner device, or directly to the S300 Mini Remote.

Fig. 69: Configuration connection



Two service cables of different length and with different connectors are available for the connection of the PC/notebook (see 13.3 on page 121).

Notes

- Ensure that the service cable is not laid in close proximity to high power electrical drives or cables carrying high power. In this way you will avoid EMC effects on the service cable.
- The service cable is only allowed to be connected for configuration and diagnostics. The service cable must be disconnected and the protective cap fitted in operation.

To configure the device, please read the user manual for the CDS (Configuration & Diagnostic Software) or the Flexi Soft Designer and use the online help function of the programs.

Note Use the password function in the CDS and protect the configuration settings from unauthorized access. Also ensure that the passwords are stored protected from unauthorized access.

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9 Commissioning

9.1 Initial commissioning

WARNING

Commissioning requires a thorough check by qualified safety personnel!

Before you operate a system protected by the S300 Mini safety laser scanner for the first time, make sure that the system is first checked and released by qualified safety personnel. The result of the test must be documented. Please read the notes in chapter 2 “On safety” on page 10.

- Prior to releasing the machine, check whether the access to the hazardous area or the hazardous point is completely monitored by the protective devices.
- Also after approval of the machine, at regular intervals (e.g. in the morning prior to starting work) check whether the OSSDs (on the S300 Mini, a safety laser scanner connected or on a safety controller) switch correctly to the OFF state as soon as there is an object in the protective field. This test should be performed along all protective field boundaries as per the specific regulations for the application (see section 9.2 “Test notes” on page 93).

9.1.1 Power-up sequence

After power up the S300 Mini runs through a power up cycle. During the power up cycle, the 7-segment display indicates the device status.

During the initial commissioning of an S300 Mini the following indications are possible:

Tab. 23: 7-segment display during and after the power up sequence on initial commissioning

Step	Display	Meaning
1	8, 8, 8, 8, 8, 8, 8, 8	Power-up cycle, testing the 7-segment display. All segments are activated sequentially.
2	6	Power up cycle, during initial commissioning: device in configuration mode
	Other display	Safety lock activated. Malfunction in external conditions or in the device itself. See section 11.4 “Error and status indications on the 7-segment display” on page 99.

Tab. 24: LED indication of the S300 Mini Standard after the power up sequence

Step	Display	Meaning
1		Device self-test
2		Device self-test
3		Device status: waiting for configuration or object in the protective field, OSSDs in the OFF state
	Other display	Safety lock activated. Malfunction (see section 11.3 “Error and status indications on the LEDs” on page 98)

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Tab. 25: LED indication of the S300 Mini Remote after the power up sequence

Step	Display	Meaning
1		Device self-test
2		Device self-test
3		Device status: waiting for configuration
	Other display	Safety lock activated. Malfunction (see section 11.3 “Error and status indications on the LEDs” on page 98)

9.2 Test notes

9.2.1 Pre-commissioning tests

The purpose of the pre-commissioning tests is to confirm the safety requirements specified in the national/international rules and regulations (EC conformity). This applies particularly to the safety requirements in the machinery directive or work equipment directive.

WARNING

Ensure that you do not place anybody at risk during initial commissioning of the machine!

Always expect that the machine, system or the protective device does not yet behave as you have planned.

- Ensure that there are no persons in the hazardous area during initial commissioning.
- Check the effectiveness of the protective device mounted to the machine, using all selectable operating modes as specified in the checklist in the annex (see section 14.2 “Checklist for the manufacturer” on page 126).
- Ensure that the operating personnel of the machine protected by the safety laser scanner are correctly instructed by qualified safety personnel before being allowed to operate the machine. Instructing the operating personnel is the responsibility of the machine owner.
- Ensure that the information label **Important information**, which is included with the safety laser scanner on delivery, is affixed to the machine in a place where it is clearly visible for the operators. Ensure that the operators have the possibility to perform this daily check correctly.
- The annex to this document includes a checklist for review by the manufacturer and OEM. Use this checklist as a reference before commissioning the system for the first time (see section 14.2 “Checklist for the manufacturer” on page 126).
- Document the adjustment of the safety laser scanner and the results of the testing during initial commissioning in a traceable manner. For this purpose also print out the complete configuration of the safety laser scanner (including protective field shapes) and include these with the documentation.

Recommendation

- Use the **Create development dump...** function in the CDS (right click on the COM interface to which the safety laser scanner is connected). You can keep these data as a backup and in this way document the state during initial commissioning at any time.

Note

Your SICK representative will be pleased to provide you with advice on initial commissioning.

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Subject to change without notice

9.2.2 Regular inspection of the protective device by qualified safety personnel

- Check the system following the inspection intervals specified in the national rules and regulations. This procedure ensures that any changes on the machine or manipulations of the protective device after the initial commissioning are detected.
- If major changes have been made to the machine or the protective device, or if the safety laser scanner has been modified or repaired, check the system again as per the checklist in the annex (see section 14.2 “Checklist for the manufacturer” on page 126).

9.2.3 Daily testing of the protective device by a specialist or authorized personnel

The effectiveness of the protective device must be checked daily by a specialist or by authorized personnel. The test must also be performed if the operating mode is changed.

WARNING

No further operation if errors occur during the test!

If any one of the following points is not met, it is not permitted to continue to work on the machine or operate the vehicle. In this case the installation of the S300 Mini must be checked by qualified safety personnel (see section 9.2.2 “Regular inspection of the protective device by qualified safety personnel” on page 94).

- The test must be carried out for the relevant preset monitoring case.
- Check the mechanical installation to ensure that all mounting screws are secure and that the is properly aligned S300 Mini.
- Check each S300 Mini device for visible changes such as damage, manipulation etc.
- Switch on the machine/system.
- Watch the LEDs on each S300 Mini.
- If not at least one LED of each S300 Mini is permanently lit when the machine/system is switched on, it is to be assumed that there is a fault in the machine or system. In this case the machine must be shut down immediately and checked by qualified safety personnel.
- Deliberately infringe the protective field while the machine is running in order to test the protective function for the entire system. The LEDs of the S300 Mini must change from green to red and the dangerous movement must stop immediately. If the S300 Mini, with the protective field that you are infringing, switches the OSSDs on another device (see 4.5.1 “External OSSDs of the S300 Mini Remote” on page 36), then on this device the LEDs must change from green to red and the dangerous movement on the machine or system connected must come to an immediate stop.
- Repeat this test at different points in the hazardous area and on all S300 Mini devices. If you discover any non-conformance of this function, the machine/system must be shut down immediately and checked by qualified safety personnel.
- For stationary applications, check that the hazardous areas marked out on the floor match the shapes of the protective fields stored in the S300 Mini and that any gaps are protected by additional safety measures. In the case of mobile applications, check that the moving vehicle actually stops in a timely manner at the protective field boundaries which are set in the S300 Mini and listed on the information label on the vehicle or in the configuration protocol. If you discover any non-conformance of this function, the machine/system/vehicle must be stopped immediately and checked by qualified safety personnel.

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10 Maintenance and care

WARNING

Do not make any repairs to the device!

The S300 Mini does not contain any repairable components. For this reason do not open the S300 Mini components and only replace the parts that are described in the following chapters as replaceable.

Switch the entire machine/system off line!

The system could inadvertently start up while you are replacing the optics cover. As a matter of principle, always isolate the machine from the power supply during all work on the machine and safety laser scanner.

10.1 Cleaning optics cover

The S300 Mini safety laser scanner is largely maintenance-free. The optics cover on the safety laser scanner should however be cleaned regularly and if it is contaminated.

- Do not use aggressive cleaning agents.
- Do not use abrasive cleaning agents.

Note Static charges cause dust particles to be attracted to the optics cover. You can diminish this effect by using the anti-static plastic cleaner (SICK part no. 5600006) and the SICK lens cloth (part no. 4003353) (see section 13.3 “Accessories/spare parts” on page 121).

How to clean the optics cover:

- Use a clean and soft brush to remove dust from the optics cover.
- Moisten the SICK optics cloth with the anti-static plastic cleaner and wipe off the window for light output on the optics cover with the cloth.

10.2 Replacing the optics cover

WARNING

Perform an optics cover calibration with the aid of the CDS after the replacement of the optics cover!

The level of contamination is measured continuously during the operation of the S300 Mini. For this purpose the optics cover calibration must first be performed; this then serves as a reference for the contamination measurement (status = not contaminated). The optics cover calibration is only allowed to be performed with a new optics cover! The new optics cover must be free of contamination at the time of the optics cover calibration. The optics cover calibration should be performed at room temperature (10-30 °C)!

If the optics cover is scratched or damaged, you must replace the optics cover. Order the replacement optics cover from SICK (see section 13.3 “Accessories/spare parts” on page 121).

Notes

- The optics cover on the S300 Mini is an optical part that must not be soiled or scratched on replacement.
- The optics cover is only allowed to be replaced by qualified safety personnel in a dust and dirt-free environment.
- Never replace the optics cover during ongoing operation, as internal parts may be irreparably damaged in certain circumstances and dust particles may enter the device.

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- It is imperative that you avoid contamination of the inside, e.g. with fingerprints.
- Do not use any additional sealant for sealing the optics cover, e.g. silicon, as these substances may affect the optics.
- Use a torque wrench (universal joint) with 2.5 mm hex socket bit.
- Mount the optics cover as per the following instructions to ensure that the housing is sealed to IP 65.

How to replace the optics cover:

Notes

- Only use a **new** optics cover (see 13.3.8 on page 123).
- When replacing the optics cover, take ESD protection measures.
- Set the torque wrench to 1.2 Nm (hand-tight) and have this at hand.

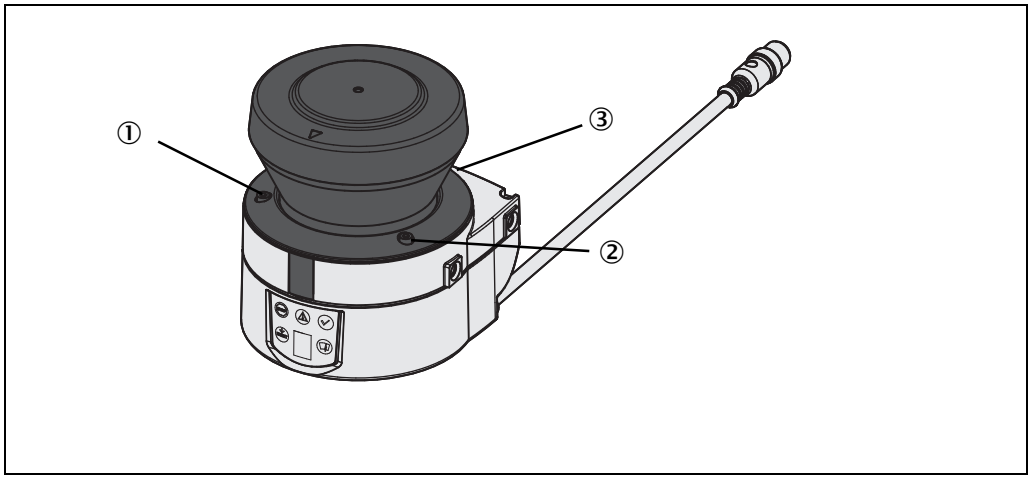
➢ Disconnect the round plug connector on the end of the connecting cable and remove the S300 Mini.

➢ Take the S300 Mini to a clean place (office, repair shop or similar).

➢ First clean the outside of the S300 Mini. This prevents foreign bodies entering the device when it is opened.

➢ Undo the fixing screws ① to ③ for the optics cover.

Fig. 70: Undo the fixing screws for the optics cover



➢ Then remove the optics cover.

➢ Check whether the mirror on the motor is clean and remove any contamination with an optic brush.

➢ Take the new optics cover out of the packaging and remove the protection for the seal.

➢ Remove any remnants of packaging.

➢ Place the optics cover on the safety laser scanner and fit the new fixing screws ① to ③.

➢ When fitting the new cover, ensure the arrow on the top of the cover points to the front and that the optics cover is fully in contact **without** a gap.

➢ Then tighten the screws with the tightening torque set.

➢ Make sure the optics cover is free of dirt and that it is not damaged.

Re-commissioning the S300 Mini:

➢ Correctly re-mount the S300 Mini (see chapter 5 “Mounting” on page 54).

➢ Connect the round plug connector on the end of the connection cable for the S300 Mini.

➢ Then perform an optics cover calibration with the aid of the CDS.

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11 Diagnostics

This chapter describes how to identify and remedy errors and malfunctions during the operation of the safety laser scanner.

11.1 In the event of faults or errors

WARNING

Do not operate if behavior is unclear!

Stop the machine, the system or the vehicle if you cannot clearly identify or allocate an error and if you cannot safely remedy the malfunction.

Repair only by authorized persons!

The improper repair of the protective device can result in the loss of the protective function. The protective device is only allowed to be repaired by the manufacturer or persons authorized by the manufacturer.

11.2 SICK support

If you cannot rectify an error with the help of the information provided in this chapter, please contact your local SICK representative.

Make a note of the telephone number of your SICK representative so that you or other users have this number easily at hand. You will find the telephone number on the last page of these operating instructions.

Telephone number of your SICK representative

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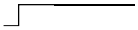
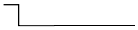
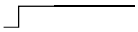
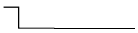
11.3 Error and status indications on the LEDs

This section describes the meaning of the error and status indications of the LEDs and how you can respond. You will find a description of the indicators in section 3.4 “Status indicators” on page 23, the connections for the outputs of the S300 Mini Standard in section 6.1 “System connection” on page 79.

Tab. 26: Error and status indications of the LEDs on the S300 Mini Standard

Display	Output level	Possible cause	Rectification of the error
	At the OSSDs	Object in the protective field, OSSDs in the OFF state	No error
	At the OSSDs 	Protective field unoccupied, OSSDs in ON state	No error
	At the warning field output[10] On the universal I/O[11]	Object in one of the warning fields	No error
	At the OSSDs On the universal I/Os	No operating voltage or voltage too low	➢ Check the voltage supply and activate, if necessary.
	On the universal I/O[12] 	Reset required	➢ Operate the control switch for restart.
	No level change	Restart delay is counting down.	➢ No action is required.
	On the universal I/O[13] 	No error	
	On the universal I/O[14]	Optics cover contaminated, no operation	➢ Clean the optics cover.
	On the universal I/O[15] 	Optics cover contaminated, still in operation	➢ Clean the optics cover.

[10] If warning field 1 is infringed.
[11] If this is configured as the output for warning field 2 and warning field 2 is infringed.
[12] If this is configured as the output for “Reset required”.
[13] If this is configured as the output for a contamination error/warning.
[14] If this is configured as the output for a contamination error.
[15] If this is configured as the output for a contamination warning.

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Tab. 27: Error and status indications of the LEDs on the S300 Mini Remote

Display	Possible cause	Rectification of the error
	Device in operation	No error
	Error **Due to the standards' situation, is not used for OSSDs in the OFF state (S300 Mini Remote does not have OSSDs).**	Depending on the cause of the error (see Tab. 28 on page 100)
	Object in one of the warning fields	No error
	Optics cover contaminated, no operation	➢ Clean the optics cover.
	Optics cover contaminated, still in operation	➢ Clean the optics cover.

11.4 Error and status indications on the 7-segment display

This section explains the meaning of the error indications on the 7-segment display and how to respond to the messages. You will find a description of the positions and symbols on the S300 Mini in section 3.4.1 "LEDs and 7-segment display" on page 23.

The lock-out operational status

In case of certain faults or an erroneous configuration, the device can go into the lock-out operational status. To place the device back in operation, proceed as follows:

➢ Rectify the cause of the fault as per Tab. 28.

➢ Switch off the power supply for the S300 Mini, wait at least 3 seconds and then switch back on the power supply.

Or:

➢ Restart the safety laser scanner with the aid of the CDS.

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Tab. 28: Error and status indications on the 7-segment display

Display	Possible cause	Rectification of the error
1, 2, 1, 1, 1, 1, -, .	Power-up cycle — all segments are activated sequentially.	No error
2	Object in protective field	No error
-	Object in warning field 1	No error
_	Object in warning field 2	No error
3	Initialization of the device or Waiting for the end of the initialization of a second device connected to the EFI	➢ The display goes out automatically when the S300 Mini has been initialized and/or the connection to the second device has been made. If the display 3 does not go off: ➢ Check whether the partner device is in operation. ➢ Check the wiring. If no partner device is connected: ➢ Check the system configuration with the aid of the CDS. Transfer the corrected configuration to the S300 Mini again.
4	Waiting for valid input signals	➢ The indication extinguishes automatically if an input signal is present that corresponds to the configured evaluation type (1-of-n or complementary). If the display 4 does not go off: ➢ Check the wiring. ➢ Check the control signals for correct switching behavior. ➢ Check, if velocity ranges are used for monitoring case switching, whether the EFI status information **Speed valid** is transferred (see Tab. 32 on page 116). ➢ Check the system configuration with the aid of the CDS. Transfer the corrected configuration to the S300 Mini again.
6	Waiting for configuration or configuration not completed	➢ The display goes off automatically once the configuration has been successfully transferred. If the display 6 does not go off: ➢ Check the system configuration with the aid of the CDS. Transfer the corrected configuration to the S300 Mini again.
6	Waiting for restart of the device	➢ Switch off the voltage supply for the S300 Mini for at least 2 seconds and then switch it back on.

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Display	Possible cause	Rectification of the error
8 or 8	Error of the external device monitoring (EDM)	➢ Check whether the contactors are working correctly or if they are wired incorrectly and rectify any error. ➢ If 8 is displayed: also switch off the voltage supply for the S300 Mini for at least 2 seconds and switch it back on.
9	Error in the control switch for restart or reset	➢ Check the functionality of the control switch. The button may be defective or permanently operated. ➢ Check the wiring of the control switch for short-circuit to 24 V.
E ↻ 1	S300 Mini has a malfunction or is faulty	➢ Switch off the voltage supply for the S300 Mini for at least 2 seconds and then switch it back on. If the display does not go off: ➢ Send the S300 Mini to the manufacturer for repair.
E ↻ 4	A second device which is connected via EFI is faulty.	➢ Check the connected device and the connection.
F ↻ 1	Overcurrent on OSSD connection 1	➢ Check the switching element connected (contactor, relay). Replace, if necessary. ➢ Check the wiring for short-circuit to 0 V.
F ↻ 2	Short-circuit to 24 V at OSSD connection 1	➢ Check the wiring for short-circuit to 24 V.
F ↻ 3	Short-circuit to 0 V at OSSD connection 1	➢ Check the wiring for short-circuit to 0 V.
F ↻ 4	Overcurrent on OSSD connection 2	➢ Check the switching element connected (contactor, relay). Replace, if necessary. ➢ Check the wiring for short-circuit to 0 V.
F ↻ 5	Short-circuit to 24 V at OSSD connection 2	➢ Check the wiring for short-circuit to 24 V.
F ↻ 6	Short-circuit to 0 V at OSSD connection 2	➢ Check the wiring for short-circuit to 0 V.
F ↻ 7	Short-circuit between OSSD connection 1 and 2	➢ Check the wiring and rectify the error.
F ↻ 9	General OSSD wiring error	➢ Check the complete wiring of the OSSDs.
C	Device is addressed as guest	No error. The symbol is displayed for approx. 2 seconds on switching on a device that is addressed as a guest.
H	Device is addressed as host	No error. The symbol is displayed for approx. 2 seconds on switching on a device that is addressed as a host.

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Display	Possible cause	Rectification of the error
1 ↻ 1	The S300 Mini is receiving no measured values within a range of at least 90° (measuring range maximum 29.9 m), it thus is not detecting any obstacles such as e.g. building walls.	➢ For the correct function of the safety laser scanner, always ensure that measured values are received within a range of 90°; this range can be moved as required within the scan range.
1 ↻ 2	Device is dazzled.	➢ Check whether the S300 Mini is being dazzled by an external light source, e.g. headlight, infrared light sources, stroboscopic light, sun etc. ➢ If necessary, re-mount the device.
1 ↻ 3	Temperature error. The operating temperature of the S300 Mini has exceeded the permissible range.	➢ Check whether the S300 Mini is operated as per the permissible ambient conditions.
L ↻ 2	Invalid configuration of the EDM	➢ Verify that the machine-side EDM is connected correctly.
L ↻ 4	The addresses of both the host device and the guest device may have been set to guest. A device connected via EFI or the connection to the device is defective or disrupted.	➢ Disconnect the connection to the host device (see section 6.1.2 on page 81). ➢ Check the connected device and the connection to this device.
L ↻ 8	Undervoltage of the supply voltage	➢ Check the power supply or the connecting cables.
L ↻ 9	There is a short-circuit between the input for the control switch for restart or reset and another input or output.	➢ Check the wiring for cross-circuits.
n ↻ 1	Input signal for an undefined monitoring case	➢ Check the path of the vehicle. Or: ➢ Check the operating process of the monitored machine or system. ➢ If necessary, check the configuration of the monitoring cases with the aid of the CDS.
n ↻ 2	Incorrect sequence on switching the monitoring cases	

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Display	Possible cause	Rectification of the error
n 3	Incorrect operation of the control inputs via EFI	➢ Check the operation of the control inputs.
n 4	Incorrect operation of A1/2 via EFI	
n 5	Incorrect operation of B1/2 via EFI	
n 6	Incorrect operation of C1/2 via EFI	
n 7	Incorrect operation of D1/2 via EFI	
n 8	Incorrect operation of E1/2 via EFI	
a	Park/stand-by mode, the OSSDs of the S300 Mini Standard are in the OFF state; the laser is deactivated.	No error. If the criteria for the park mode or the stand-by mode are withdrawn, readiness for operation is re-established. If the display a does not go off: ➢ Test the level(s) at the universal I/O and at the control inputs that switch to the monitoring case with park mode.
P	A device connected via EFI reports a malfunction.	➢ Carry out a fault diagnosis of the device connected with the S300 Mini.
u	Optics cover calibration active	No error
u 1	Window for light output on the optics cover contaminated	➢ Clean the window for the light output on the optics cover.
u 8 and u 9	Dazzling of the contamination measurement (there may not be an optics cover fitted)	➢ Check whether the S300 Mini is being dazzled by an external light source, e.g. headlight, infrared light source, stroboscopic light, sun etc. Or: ➢ Fit the new optics cover (then perform optics cover calibration).

Note If you have problems during troubleshooting, contact SICK support. Keep a copy of the print out of the results of the diagnostics at hand.

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11.4.1 The lock-out operational status

In case of certain faults or an erroneous configuration, the system can go into the lock-out status. The 7-segment display on the safety laser scanner then indicates 6, 8, d, E, F, I, L, n, P or u. To place the device back in operation, proceed as follows:

- ➢ Rectify the cause of the fault as per Tab. 28.
- ➢ Switch off the voltage supply for the S300 Mini for at least 2 seconds and then switch it back on.

Or:

- ➢ Restart the safety laser scanner with the aid of the CDS.

11.5 Extended diagnostics

The CDS software supplied with the device (Configuration & Diagnostic Software) includes extended diagnostic options. It allows you to narrow down the problem if the error is non-specific or if you experience usage downtime problems. Detailed information to be found ...

- in the online help for the CDS (Configuration & Diagnostic Software).
- in the user manual for the CDS.

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12 Technical specifications

12.1 Characteristics

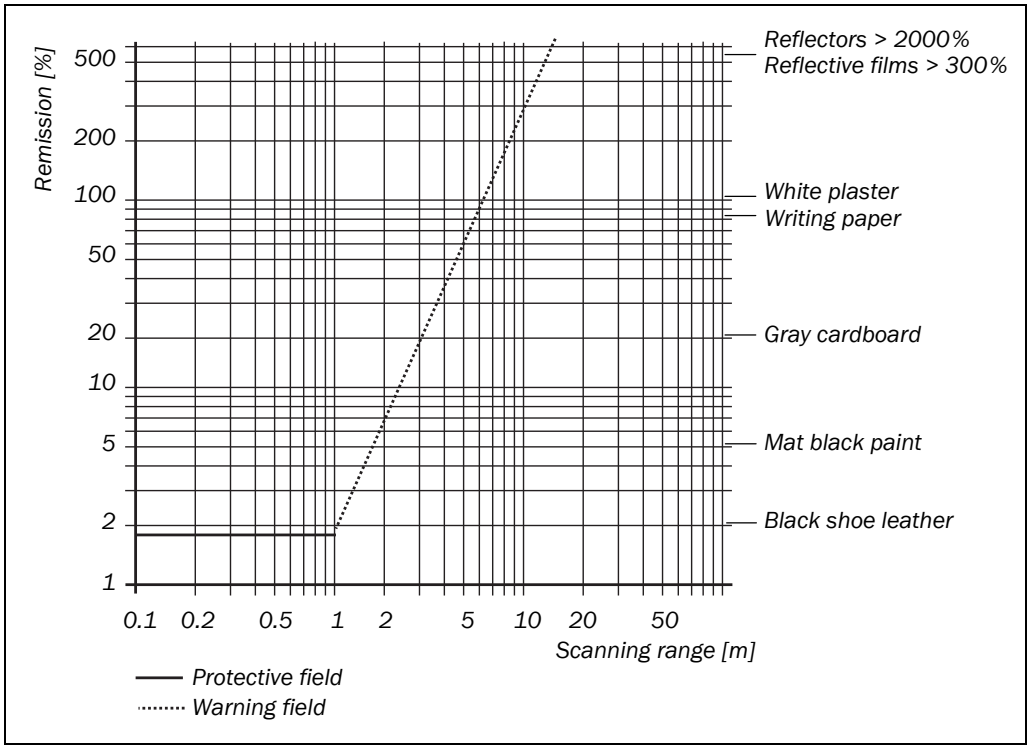

Fig. 71: Diagram scanning range S300 Mini Short Range

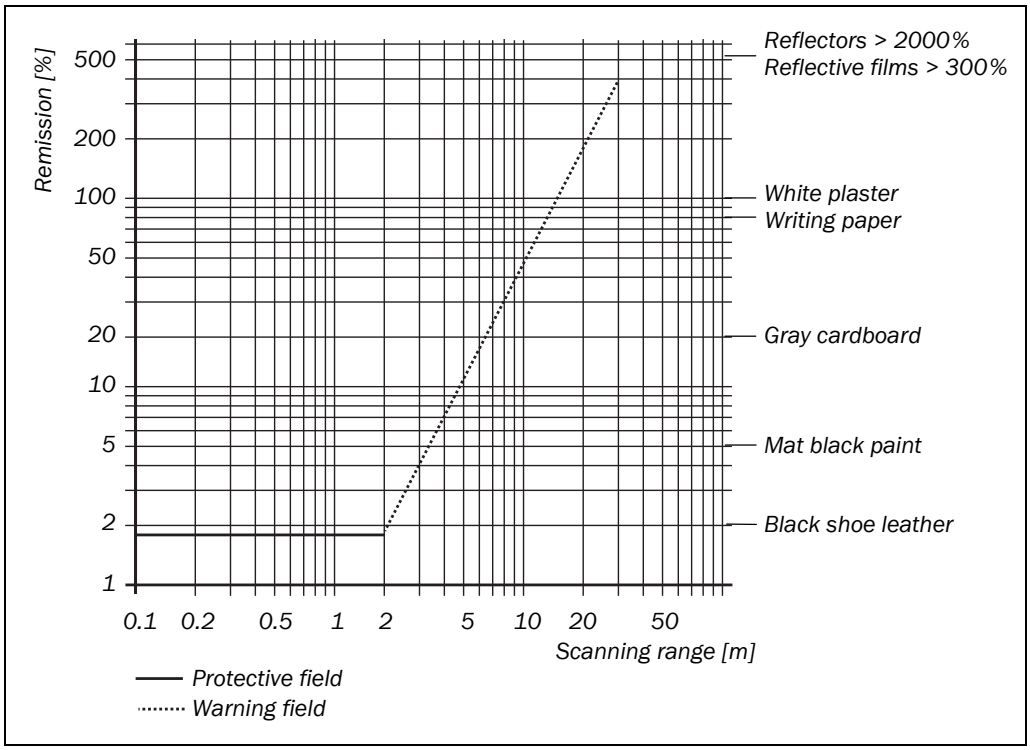

Fig. 72: Diagram scanning range S300 Mini Medium Range

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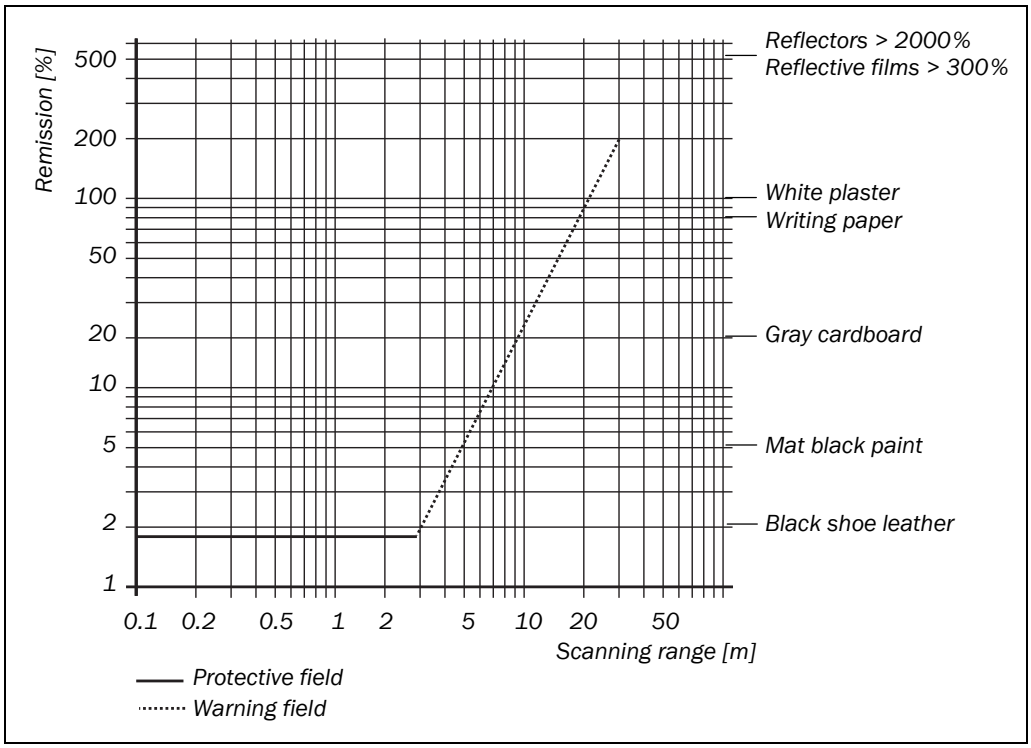
Fig. 73: Diagram scanning range S300 Mini Long Range



12.2 OSSD response times

The total response time of your application is dependent on ...

- the basic response time of the S300 Mini.
- the multiple sampling set.
- the OSSDs used.

How to calculate the total response time T_S:

$T_S = t_B + T_{MFA} + T_{EFIO}$

Where ...

t_B = Basic response time = 80 ms

T_{MFA} = Supplement due to multiple sampling > 2

T_{EFIO} = Supplement for the usage of external OSSDs via EFI

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Multiple sampling

On the S300 Mini at least double multiple sampling is always set. For a multiple sampling of 3 or higher you must add a supplement of 80 ms to the basic response time.

Tab. 29: Supplements for multiple sampling

Multiple sampling	Supplement	Basic response time + supplement
2 times (basic setting)	0 ms	80 ms
3 times	40 ms	120 ms
4 times	80 ms	160 ms
5 times	120 ms	200 ms
6 times	160 ms	240 ms
7 times	200 ms	280 ms
8 times	240 ms	320 ms
9 times	280 ms	360 ms
10 times	320 ms	400 ms
11 times	360 ms	440 ms
12 times	400 ms	480 ms
13 times	440 ms	520 ms
14 times	480 ms	560 ms
15 times	520 ms	600 ms
16 times	560 ms	640 ms

12.2.1 External OSSDs of the S300 Mini Remote

If you use the OSSDs on another device via the EFI as external switching outputs (for example those on an S3000 Expert), the response time will increase by 20 ms.

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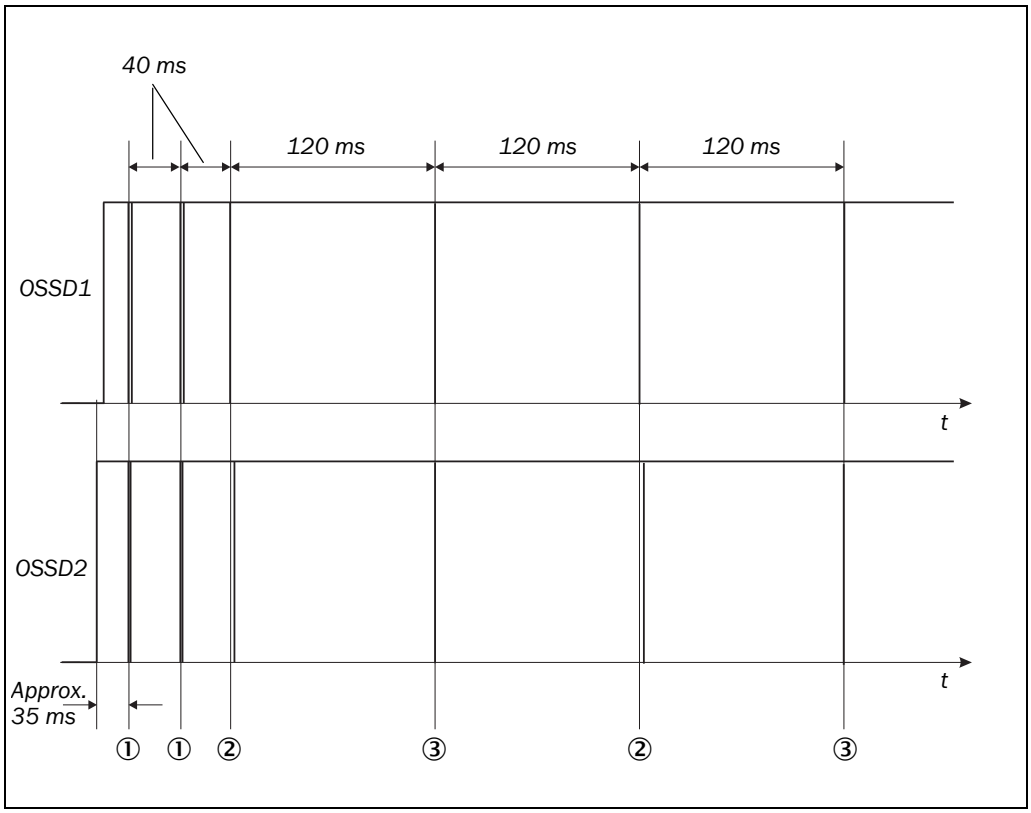
12.3 Timing behavior of the OSSDs of the S300 Mini Standard

The S300 Mini Standard tests the OSSDs immediately after switch on and then at regular intervals. For this purpose the S300 Mini Standard briefly switches off both OSSDs (for 300 µs) and checks whether the OSSDs switch to the OFF state during this time.

Note Ensure that the safety inputs on the controller used do not respond to these test pulses and as a result cause the machine or system to unintentionally shutdown!

Fig. 74: Diagram of the test pulses at the OSSDs



Approx. 35 ms after the switch on of the OSSDs, the S300 Mini Standard performs the first voltage test and then after a half basic response time (40 ms) a second voltage test.

After a further half basic response time of the S300 Mini Standard there is a shut-down test ②, 120 ms later a further voltage test ③. Then the S300 Mini Standard performs a shut-down test and a voltage test alternately at an interval of 120 ms. Fig. 75, Fig. 76 and Fig. 77 show the pulse duration for the individual tests.

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Fig. 75: Voltage test after switching on the OSSDs

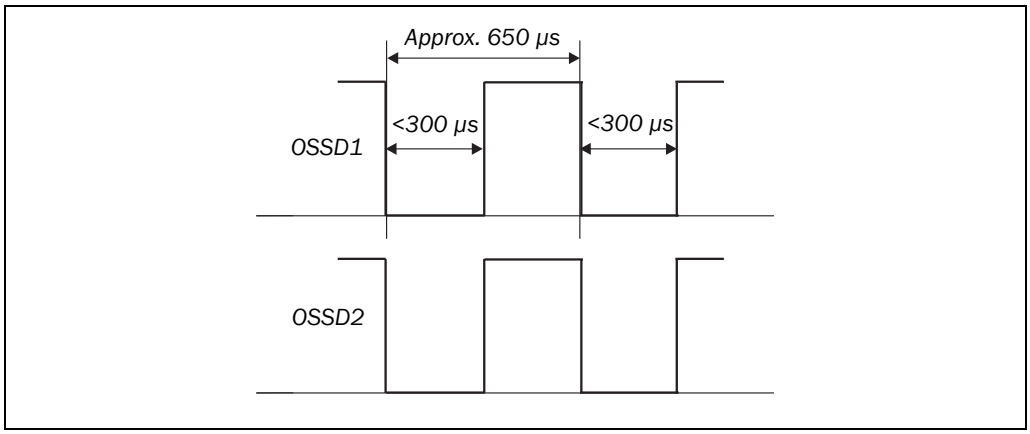


Fig. 76: Shut-down test

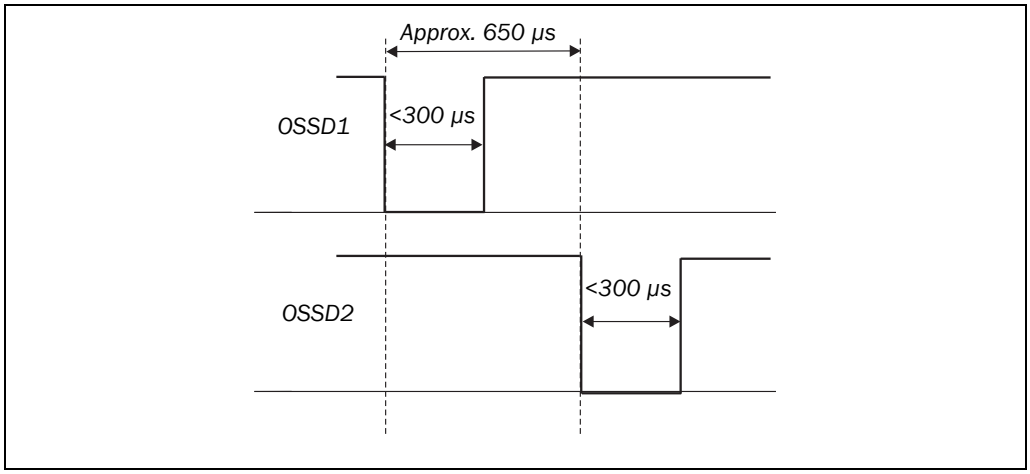
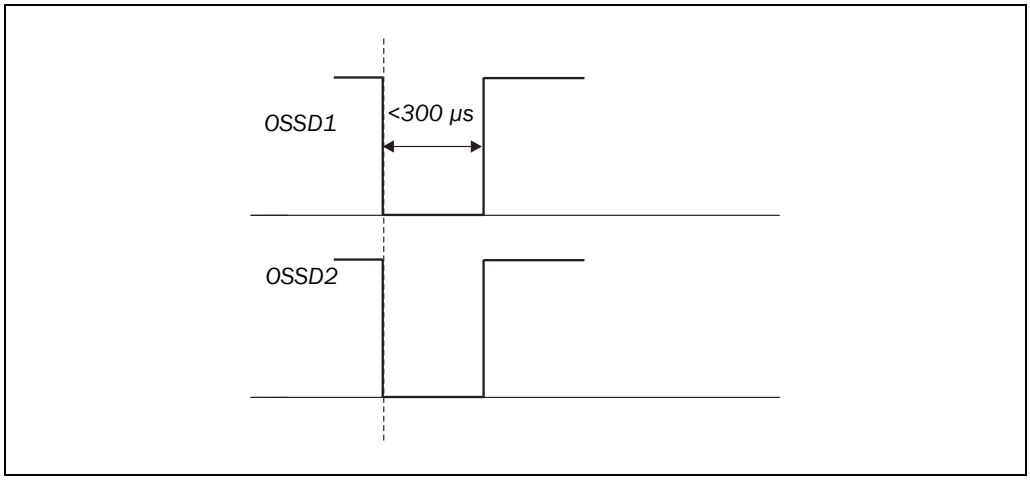


Fig. 77: Voltage test



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12.4 Data sheet

Tab. 30: Data sheet S300 Mini

	Minimum	Typical	Maximum
General data			
Type	3 (EN 61496-1)		
Safety Integrity Level[16)]	SIL2 (IEC 61508)		
SIL claim limit[16)]	SILCL2 (EN 62061)		
Category	Category 3 (EN ISO 13849-1)		
Performance Level[16)]	PL d (EN ISO 13849-1)		
PFHd (mean probability of a dangerous failure per hour)	8×10^{-8}		
T_M (mission time)	20 years (EN ISO 13849)		
Laser protection class	Laser class 1 (according to IEC 60825-1 as well as CDRH 21 CFR 1040.10 and 1040.11; excluded are deviations due to Laser Notice No. 50, dated 24.06.2007)		
Enclosure rating	IP 65 (EN 60529)		
Protection class	III (EN 50178 and EN 60950)		
Ambient operating temperature	–10 °C		+50 °C
Storage temperature range	–25 °C –25 °C		+50 °C +70 °C (≤24 h)
Humidity (taking into account the ambient operating temperature)	EN 61496-1, section 5.1.2 and 5.4.2, as well as CLC/TS 61496-3, section 5.4.2		
Vibration	EN 61496-1 as well as CLC/TS 61496-3		
Frequency range	10 Hz		150 Hz
Amplitude	0.35 mm or 5 g		
Shock resistance	EN 61496-1, section 5.1 and 5.4.4 as well as CLC/TS 61496-3, section 5.4.4		
Single shock	15 g, 11 ms		
Continuous shock	10 g, 16 ms		
Sender	Pulsed laser diode		
Wavelength	895 nm	905 nm	915 nm
Divergence of the collimated beam (solid angle)		14 mrad	
Pulse duration		5.0 ns	5.5 ns
Average output power			3.42 mW
Light spot size at optics cover		8 mm	
Size of light spot at 2.0 m scanning range		28 mm	

[16)] For detailed information on the safety design of your machine/system, please contact your local SICK representative.

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	Minimum	Typical	Maximum
Housing			
Material		Aluminium die-cast	
Color		RAL 1021 (rapeseed yellow) and RAL 9005 (black)	
Optics cover			
Material		Polycarbonate	
Surface finish		Outside with scratch-resistant coating	
Dimensions S300 Mini			
Height			116 mm
Width			102 mm
Depth			105 mm
Dimensions connecting cable			
Length		250 mm	
Diameter of round plug connector			15 mm
Total weight (without connecting cables)		0.8 kg	

Functional data

Resolution of the S300 Mini Short Range	30, 40, 50, 70 mm		
Protective field of the S300 Mini Short Range			
At 30 mm resolution			1.00 m
At 40 mm resolution			1.00 m
At 50 mm resolution			1.00 m
At 70 mm resolution			1.00 m
Resolution of the S300 Mini Medium Range	30, 40, 50, 70 mm		
Protective field of the S300 Mini Medium Range			
At 30 mm resolution			1.25 m
At 40 mm resolution			1.60 m
At 50 mm resolution			2.00 m
At 70 mm resolution			2.00 m
Resolution of the S300 Mini Long Range	30, 40, 50, 70, 150 mm		
Protective field of the S300 Mini Long Range			
At 30 mm resolution			1.25 m
At 40 mm resolution			1.60 m
At 50 mm resolution			2.10 m
At 70 mm resolution			3.00 m
At 150 mm resolution			3.00 m
Scan angle			270°
Remission	1.8%		Several 1000% (reflectors[17])

[17] Complies with Diamond Grade 3000X™ (approx. 1250 cd/lx × m²).

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	Minimum	Typical	Maximum
Angular resolution		0.5°	
Protective field supplement generally necessary			100 mm
Supplement for retroreflectors in scan plane at a distance of less than 1 m to the protective field boundary			200 mm
Evenness of the scan field at 2 m			±50 mm
Distance from mirror axis of rotation (zero point on the X and Y axis) to the rear of the device		55 mm	
Distance between centre of the scan plane and the bottom edge of the housing		80 mm	
Warning field[18)]		8 m	
Distance measuring range			30 m
Number of multiple samplings (configurable via CDS)	2		16
Power-up delay of a configured device		18 s	
Restart after (configurable)	2 s		60 s
Basic response time[19)]	80 ms		

[18)] The detection capability of the warning field is dependent on the remission of the objects to be detected (see section 12.1 on page 105).
[19)] The total response time of your application is dependent on further factors (see section 12.2 on page 106).

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	Minimum	Typical	Maximum
Electrical data			
Supply voltage (SELV)[20)21)]	16.8 V	24 V	30 V
Permissible residual ripple[22)]			±5 %
Switch on current[23)]			2.0 A
Operating current without output load[24)] S300 Mini Standard S300 Mini Remote S300 Mini Standard Long Range S300 Mini Remote Long Range		 0.16 A 0.14 A 0.18 A 0.16 A	 0.20 A 0.20 A 0.25 A 0.22 A
Operating current with max. output load[24)] S300 Mini Standard S300 Mini Remote S300 Mini Standard Long Range S300 Mini Remote Long Range			 1.35 A 0.22 A 1.35 A 0.24 A
Power consumption without output load[24)] S300 Mini Standard S300 Mini Remote S300 Mini Standard Long Range S300 Mini Remote Long Range		 3.9 W 3.4 W 4.4 W 3.9 W	 4.8 W 4.8 W 6.0 W 5.3 W
Power consumption with max. output load[24)] S300 Mini Standard S300 Mini Remote S300 Mini Standard Long Range S300 Mini Remote Long Range			 33 W 5.3 W 33 W 5.8 W
Power consumption in the stand-by mode or park mode without output load[24)] S300 Mini Standard/Remote S300 Mini Standard Long Range S300 Mini Remote Long Range		 3.6 W 4.4 W 3.9 W	 4.8 W 6.0 W 5.3 W
Electrical connection	Connecting cable with round plug connector		
Cable length for power supply tolerance ±10 %			25 m
Cable length for power supply tolerance ±5 %			34 m
Cable length for power supply tolerance ±1 %			40 m

[20)] Operation only in a short-circuit protected system with max. 8 A.
[21)] To meet the requirements of the relevant product standards (e.g. EN 61496-1), the external voltage supply for the devices must be able to bridge a brief mains failure of 20 ms. Power supplies according to EN 60204-1 satisfy this requirement. Suitable power supplies are available as accessories from SICK.
[22)] The absolute voltage level must not drop below the specified minimum voltage.
[23)] The load currents for the input capacitors are not taken into account.
[24)] With a typical supply voltage of 24 V.

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	Minimum	Typical	Maximum
Universal I/Os and output for warning field 1			
Input resistance when HIGH		2 kΩ	
Voltage for HIGH	11 V	24 V	30 V
Voltage for LOW	–3 V	0 V	5 V
Input capacitance		15 nF	
Static input current	6 mA		15 mA
Actuating time of the control switch for restart	120 ms	200 ms	
HIGH switching voltage at 100 mA	V_S – 3.3 V		V_S
Source switching current		100 mA	200 mA
Current limiting (after 5 ms at 25 °C)	600 mA		920 mA
Power up delay		1.4 ms	2 ms
Switch off delay		0.7 ms	2 ms
Response time Output for warning field 1 Universal I/O with configuration as output for warning field 2	Corresponds to the resulting response time of the OSSDs plus 50 ms		
OSSDs (only S300 Mini Standard)			
Output signal switching device pair	2 PNP semiconductors, short-circuit protected[25], cross-circuit monitored		
Safe state in case of an error	At least one OSSD is in the OFF state.		
HIGH switching voltage at 250 mA	V_S – 2.7 V		V_S
Switching voltage LOW	0 V	0 V	2 V
Source switching current[26]	6 mA		250 mA
Leakage current[27]			250 µA
Load inductance			2.2 H
Load capacity			2.2 µF at 50 Ω
Switching sequence (without switching)			5 1/s
Permissible cable resistance[28]			2.5 Ω
Test pulse width[29]		230 µs	300 µs
Test frequency		120 ms	
Power-up delay of the OSSDs from red to green		120 ms	
Time offset on switching the OSSDs between OSSD2 and OSSD1			2 ms

[25] Applies to the voltage range between $V[0]_S$ and 0 V.
[26] Switching currents up to 500 mA are allowed briefly (≤100 ms).
[27] In the case of a fault (0 V cable open circuit) maximally the leakage current flows in the OSSD cable. The downstream controller must detect this status as LOW. An FPLC (fail-safe programmable logic controller) must be able to identify this status.
[28] Make sure to limit the individual line core resistance to the downstream controller to this value to ensure that a cross-circuit between the outputs is safely detected. (Also note EN 60204-1.)
[29] When active, the outputs are tested cyclically (brief LOW). When selecting the downstream controllers, make sure that the test signals do not result in deactivation.

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	Minimum	Typical	Maximum
Configuration and diagnostics interface			
Communication protocol	RS-232 (proprietary)		
Transmission speed	38 400 Baud		
Cable length at 38 400 Baud and 0.25 mm² cables			15 m
Galvanic isolation	No		
Output TxD HIGH	5 V		15 V
Output TxD LOW	–15 V		–5 V
Voltage range RxD	–15 V		15 V
Switching threshold RxD LOW	–15 V		0.4 V
Switching threshold RxD HIGH	2.4 V		15 V
Short-circuit current at TxD	–60 mA		60 mA
Max. voltage level at RxD	–15 V		15 V
Max. voltage level at TxD	–11 V		11 V
EFI — safe SICK device communication (only S300 Mini Remote)			
Cable length with 500 kBaud (only pre-assembly extension cables allowed, see 13.3.2 on page 122)			20 m
Galvanic isolation	No		

12.5 EFI status information and control commands

If devices are connected together via EFI, EFI status information and control commands are exchanged. Tab. 31 and Tab. 32 shows the status information that can be retrieved and the possible control commands for the S300 Mini.

Note The information in square brackets reflects the names used in the CDS and in the Flexi Soft Designer.

Tab. 31: Status information of the S300 Mini (data from the S300 Mini)

Status information	Meaning/effect
Warning field bit [WF]	• Logical 1, if both warning fields of the S300 Mini are unoccupied • Logical 0, if one of the warning fields of the S300 Mini is infringed
Protective field [PF]	• Logical 1, if the protective field is unoccupied
Warning field [WF1]	• Logical 1, if the active allocated warning field is unoccupied
Warning field 2 [WF2]	• Logical 1, if the active allocated warning field is unoccupied
Contamination [Weak]	• Logical 1, if the optics cover is contaminated
I/O error [I/O Error]	• Logical 0, if there is no error on the S300 Mini • Logical 1, if there is an error on the S300 Mini

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Tab. 32: Control features on the S300 Mini (data to the S300 Mini)

Control feature	Meaning/effect
Static input information A1 [In A1]	• Logical 1, stimulates control input A1 of the S300 Mini
Static input information A2 [In A2]	• Logical 1, stimulates control input A2 of the S300 Mini
Static input information B1 [In B1]	• Logical 1, stimulates control input B1 of the S300 Mini
Static input information B2 [In B2]	• Logical 1, stimulates control input B2 of the S300 Mini
Static input information C1 [In C1]	• Logical 1, stimulates control input C1 of the S300 Mini
Static input information C2 [In C2]	• Logical 1, stimulates control input C2 of the S300 Mini
Static input information D1 [In D1]	• Logical 1, stimulates control input D1 of the S300 Mini
Static input information D2 [In D2]	• Logical 1, stimulates control input D2 of the S300 Mini
Static input information E1 [In E1]	• Logical 1, stimulates control input E1 of the S300 Mini
Static input information E2 [In E2]	• Logical 1, stimulates control input E2 of the S300 Mini
Stand-by	• Logical 1, stimulates operational status Stand-by
Speed valid	• Logical 1 signals a valid velocity being present on the incremental encoder inputs. • Logical 0 signals an invalid velocity being present on the incremental encoder inputs (velocity in a range that is not configured or difference allowed between the incremental encoders exceeded).
Speed	• 12 bits for the transmission of the velocity 100000110000 = –2000 cm/s 000000000000 = 0 cm/s 011111010000 = +2000 cm/s
I/O error [I/O Error]	• Logical 0, if there is no error on the connected partner device • Logical 1, if there is an error on the connected partner device

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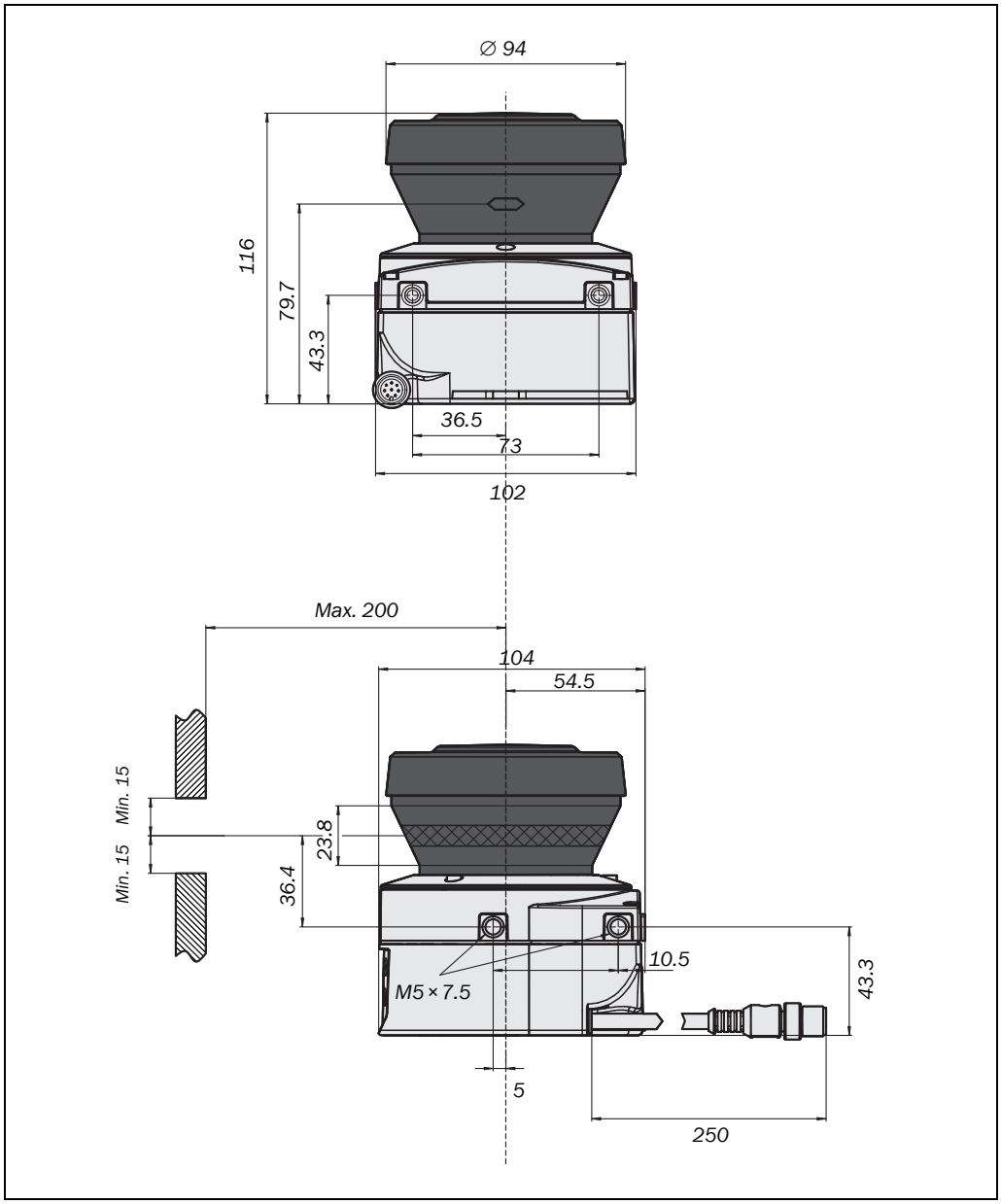
12.6 Dimensional drawings

12.6.1 S300 Mini

Fig. 78: Dimensional drawing S300 Mini (mm)



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12.6.2 Mounting kits

Fig. 79: Dimensional drawing, mounting kit 1a (mm)

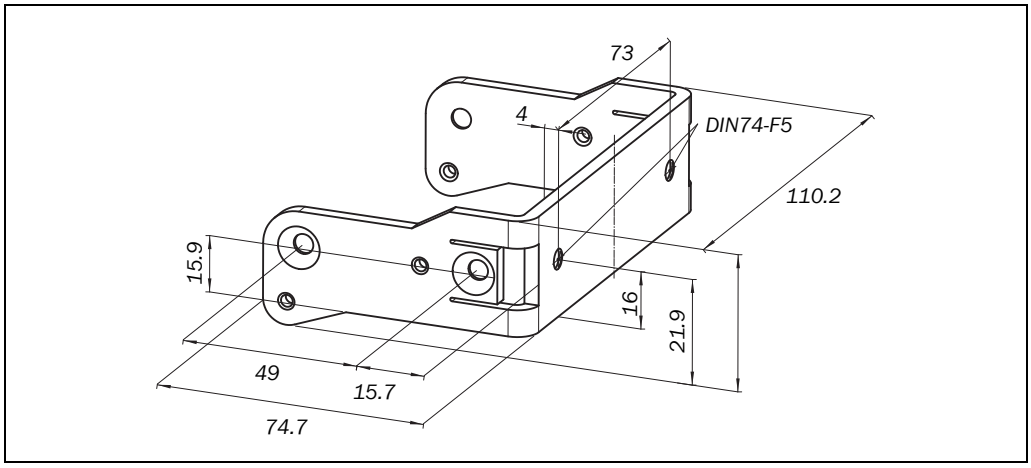

Fig. 80: Dimensional drawing, mounting kit 1b (mm)

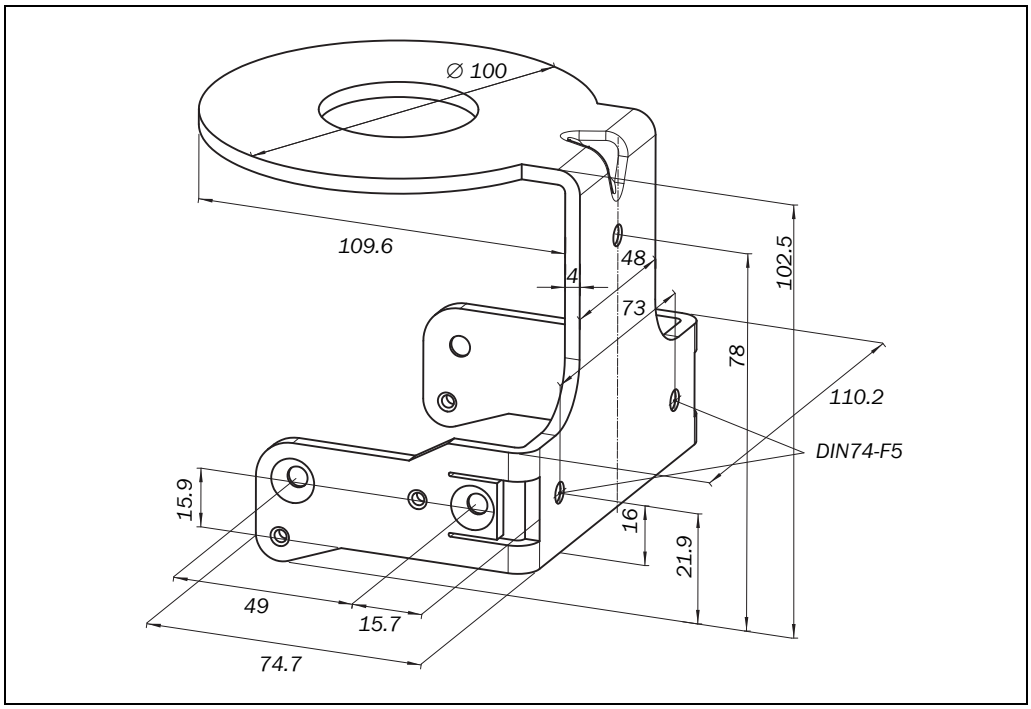

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Fig. 81: Dimensional drawing, mounting kit 2 (mm)

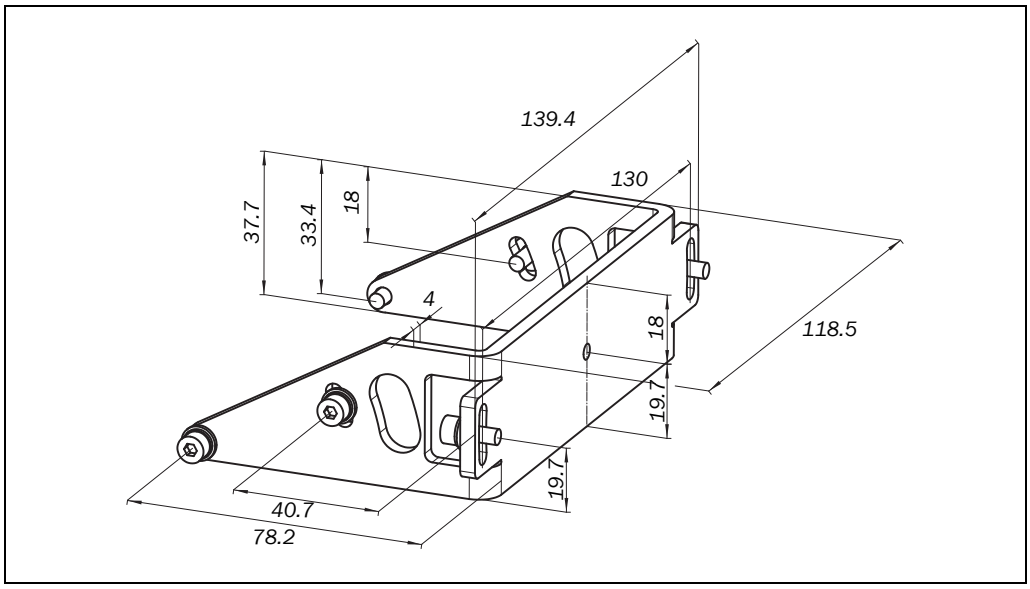
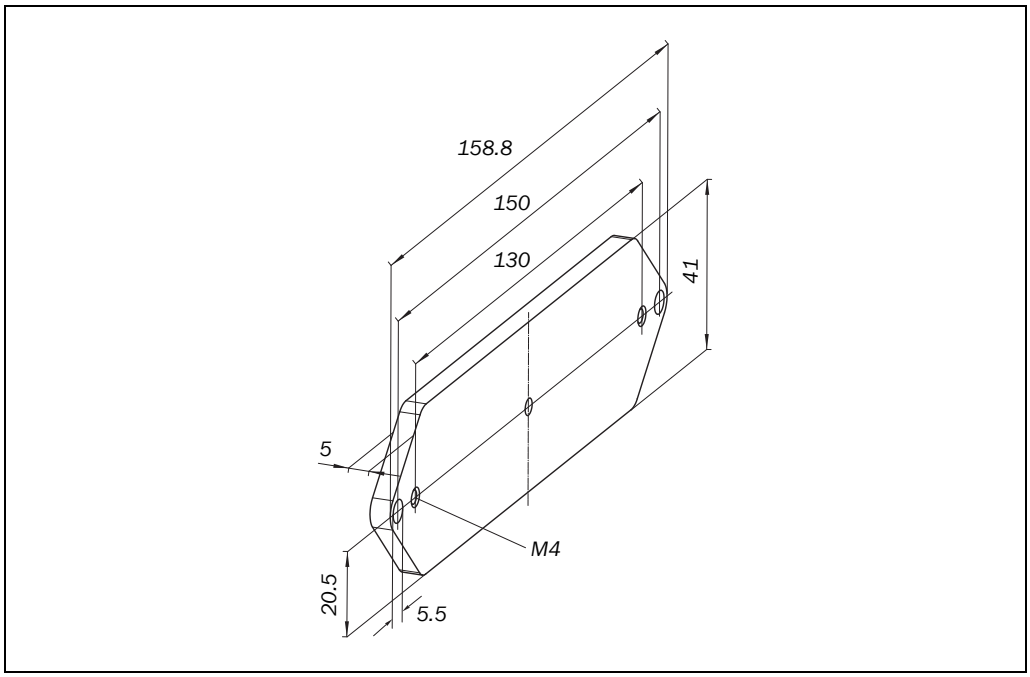


Fig. 82: Dimensional drawing, mounting kit 3 (mm)



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12.6.3 Scan plane origin

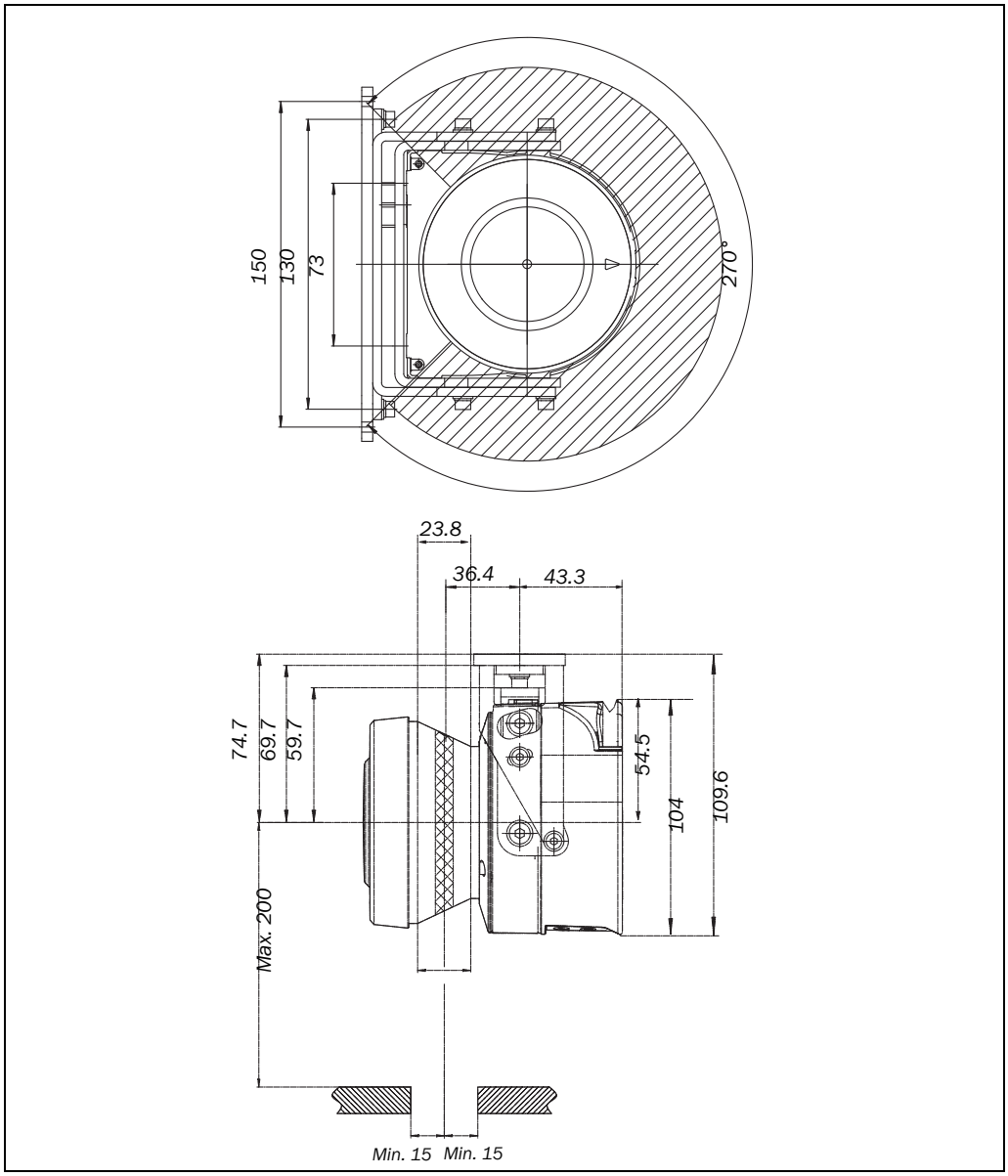

Fig. 83: Dimensional drawing of the scan plane with mounting kit 1a, 2 and 3 (mm)

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13 Ordering information

13.1 Items supplied S300 Mini

- safety laser scanner
- operating instructions and CDS (Configuration & Diagnostic Software) on CD-ROM
- adhesive label **Important information**

Note Extension cable of the S300 Mini not included.

13.2 Available systems

Tab. 33: Part numbers systems

Device type	Part	Part number
S32B-0011BA	S300 Mini Standard, Short Range (1 m scanning range)	1058000
S32B-2011BA	S300 Mini Standard, Medium Range (2 m scanning range)	1050932
S32B-2011EA	S300 Mini Remote, Medium Range (2 m scanning range)	1051884
S32B-3011BA	S300 Mini Standard, Long Range (3 m scanning range)	1056430
S32B-3011EA	S300 Mini Remote, Long Range (3 m scanning range)	1056431

13.3 Accessories/spare parts

13.3.1 Mounting kits

Tab. 34: Part numbers mounting kit

Mounting kit	Description	Part number
1a	Mounting bracket for direct mounting at the rear on wall or machine	2034324
1b	Mounting bracket for direct mounting at the rear on wall or machine, with protection for the optics cover	2034325
2	Mounting bracket only in combination with mounting bracket 1a or 1b, cross-wise adjustment possible	2039302
3	Mounting plate only in combination with mounting bracket 2, longitudinal adjustment possible	2039303

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13.3.2 Pre-assembled extension cables

Tab. 35: Part numbers S300 Mini Standard extension cables

Part	Description	Part number
Straight socket, 2.5 m	Pre-assembled 8-core extension cables, screened, for S300 Mini Standard	6020537
Straight socket, 5 m		6020354
Straight socket, 7.5 m		6020353
Straight socket, 10 m		6020352
Straight socket, 15 m		6020872
Straight socket, 20 m		6033096
Angled socket, 5 m		6021342
Angled socket, 7.5 m		6034783
Angled socket, 10 m		6035566
Angled socket, 15 m		6021343

Tab. 36: Part numbers S300 Mini Remote extension cables

Part	Description	Part number
Straight socket, 2.5 m	Pre-assembled 8-core extension cables, screened, for S300 Mini Remote	6042337
Straight socket, 5 m		6042338
Straight socket, 7.5 m		6042339
Straight socket, 10 m		6042340
Straight socket, 15 m		6042341
Straight socket, 20 m		6042342

13.3.3 Service cables

Tab. 37: Part numbers service cables

Part	Description	Part number
Service cable 2 m	For connecting the configuration connection to the serial interface on the PC M8 × 4 pin/D-Sub 9 pin, approx. 2 m	6021195
Service cable 10 m	For connecting the configuration connection to the serial interface on the PC M8 × 4 pin/D-Sub 9 pin, approx. 10 m	2027649
USB service cable 2 m	For connecting the configuration connection to the USB interface on the PC M8 × 4 pin/USB-A plug, approx. 2 m	6034574
USB service cable 10 m	For connecting the configuration connection to the USB interface on the PC M8 × 4 pin/USB-A plug, approx. 10 m	6034575
USB/RS-232 adapter	USB-A plug to D-Sub socket, 9-pin	6035396

13.3.4 Documentation

Tab. 38: Part numbers documentation

Part	Part number
CDS (Configuration & Diagnostic Software) on CD-ROM including online documentation and operating instructions in all available languages	2032314

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13.3.5 Safety relays/compact safety controller

Tab. 39: Part numbers safety relays/compact safety controller

Part	Description	Part number
UE10-2FG3	Safety relay UE10-2FG3	1043916
UE12-2FG3	Safety relay UE12-2FG3	1043918
UE10-3OS2	Safety relay UE10-3OS with screw type terminals	6024917
UE10-3OS3	Safety relay UE10-3OS with removable terminals	6024918

13.3.6 Safety controllers

Tab. 40: Part numbers safety controllers

Part	Description	Part number
FX3-CPU000000	Flexi Soft CPU0 main module Dual level spring clamp terminals	1043783
FX3-CPU130002	Flexi Soft CPU1 main module 2 EFI connections Dual level spring clamp terminals	1043784
FX3-XTIO84002	Flexi Soft XTIO expansion module 8 inputs/4 outputs Dual level spring clamp terminals	1044125
FX3-XTDI80002	Flexi Soft XTDI input expansion module 8 inputs, dual level spring clamp terminals	1044124
FX3-MPL000001	Flexi Soft system plug	1043700
UE410-MU3T5	Flexi Classic main module	6026136
UE410-XU3T5	Flexi Classic expansion module	6032470
UE410-8DI3	Flexi Classic input expansion module	6026139

13.3.7 Network solutions

Tab. 41: Part numbers network solutions

Part	Description	Part number
UE4140	EFI gateway PROFIsafe	1029098
UE1140	EFI gateway PROFIBUS	1029099
UE1840	EFI gateway Ethernet TCP/IP	1029100
UE1940	EFI gateway CANopen	1040397
UE4740	EFI gateway PROFINET IO PROFIsafe	1046978

13.3.8 Miscellaneous

Tab. 42: Part numbers miscellaneous

Part	Description	Part number
Optics cover	Spare parts set for optics cover with replacement seal and screws	2039248
Plastic cleaner	Plastic cleaner and care product, anti-static	5600006
Lens cloth	Cloth for cleaning the optics cover	4003353
Power supply, 2.1 A	Power supply, 24 V DC, 2.1 A, 50 W	7028789
Power supply, 3.9 A	Power supply, 24 V DC, 3.9 A, 95 W	7028790
LS70b	Scan finder	6020756

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14 Annex

14.1 EC declaration of conformity

Fig. 84: EC declaration of conformity (page 1)

SICK

TYPE: S300 MINI	Ident-No.: 9163500

EC declaration of conformity en
The undersigned, representing the following manufacturer herewith declares that the product is in conformity with the provisions of the following EC directive(s) (including all applicable amendments), and that the respective standards and/or technical specifications have been applied.

EG-Konformitätserklärung de
Der Unterzeichner, der den nachstehenden Hersteller vertritt, erklärt hiermit, dass das Produkt in Übereinstimmung mit den Bestimmungen der nachstehenden EG-Richtlinie(n) (einschließlich aller zutreffenden Änderungen) ist, und dass die entsprechenden Normen und/oder technischen Spezifikationen zur Anwendung gelangt sind.

ЕС декларация за съответствие bg
Подписалият, който представя долуспоменатия производител, обявява, че продуктът съответва на разпоредбите на долуизброените директиви на ЕС (включително на всички действащи изменения) и че отговаря на съответните норми и/или технически спецификации за приложение.

ES prohlášení o shodě cs
Níže podepsaný, zastupující následujícího výrobce, tímto prohlašuje, že výrobek je v souladu s ustanoveními následující(ch) směrnice (směrnic) ES (včetně všech platných změn) a že byly použity odpovídající normy a/nebo technické specifikace.

EF-overensstemmelseserklæring da
Undertegnede, der repræsenterer følgende producent erklærer hermed at produktet er i overens-stemmelse med bestemmelserne i følgende EF-direktiv(er) (inklusive alle gældende ændringer) og at alle tilsvarende standarder og/eller tekniske specifikationer er blevet anvendt.

ΕΕ-Δήλωση συμμόρφωσης el
Ο Υπογράφων, εκπροσωπών τον ακόλουθο κατασκευαστή δηλώνει με το παρόν έγγραφο ότι το προϊόν συμμορφώνεται με τους όρους της (των) ακόλουθης (-ων) Οδηγίας (-ών) της ΕΕ (συμπεριλαμβανομένων όλων των εφαρμοζόμενων τροποποιήσεων) και ότι έχουν εφαρμοστεί τα αντίστοιχα πρότυπα και/ή οι τεχνικές προδιαγραφές.

Declaración de conformidad CE es
El abajo firmante, en representación del fabricante indicado a continuación, declara que el producto es conforme con las disposiciones de la(s) siguiente(s) directiva(s) de la CE (incluyendo todas las modificaciones aplicables) y que las respectivas normas y/o especificaciones técnicas han sido aplicadas.

EÜ vastavusdeklaratsioon et
Allakirjutanu, kes esindab järgmist tootjat, kinnitab käesolevaga, et antud toode vastab järgneva(te) EÜ direktiivi(de) sätetele (kaasa arvatud kõikidele asjakohastele muudatustele) ja et on kohaldatud vastavaid nõudeid ja/või tehnilisi kirjeldusi.

EY-vaatimustenmukaisuusvakuutus fi
Allekirjoittanut, joka edustaa alla mainittua valmistajaa, vakuuttaa täten, että tuote on seuraavan (-ien) EU-direktiivin (-ien) vaatimusten mukainen (mukaan lukien kaikki sovellettavat muutokset) ja että vastaavia standardeja ja teknisiä erittelyjä on sovellettu.

Déclaration CE de conformité fr
Le soussigné, représentant le constructeur ci-après, déclare par la présente que le produit est conforme aux exigences de la (des) directive(s) CE suivantes (y compris tous les amendements applicables) et que les normes et/ou spécifications techniques correspondantes ont été appliquées.

EK megfelelőségi nyilatkozat hu
Alulírott, az alábbi gyártó képviseletében ezennel kijelenti, hogy a termék megfelel az alábbi EK-irányelv(ek) követelményeinek (beleértve azok minden vonatkozó módosítását) és kijelenti hogy a megfelelő szabványokat és/vagy műszaki előírásokat alkalmazta.

EB-samræmisyfirlýsing is
Undirritaður, fyrir hönd framleiðandans sem nefndur er hér að neðan, lýsir því hér með yfir að varan er í samræmi við ákvæði eftirtalinna EB-tilskipana (að meðtöldum öllum breytingum sem við eiga) og að varan er í samræmi við viðeigandi staðla og/eða tækniforskriftir.

Dichiarazione CE di conformità it
Il sottoscritto, rappresentante il seguente costruttore dichiara qui di seguito che il prodotto risulta in conformità a quanto previsto dalla(e) seguente(i) direttiva(e) comunitaria(e) (comprese tutte le modifiche applicabili) e che sono state applicate tutte le relative norme e/o specifiche tecniche.

EB atitikties deklaracija lt
Pasirašiusysis, atstovaujantis šiam gamintojui deklaruoja, kad gaminys atitinka šios (-ių) EB direktyvos (-ų) reikalavimus (įskaitant visus taikytinus keitinius) ir kad buvo taikomi antrajame puslapyje nurodyti standartai ir (arba) techninės specifikacijos.

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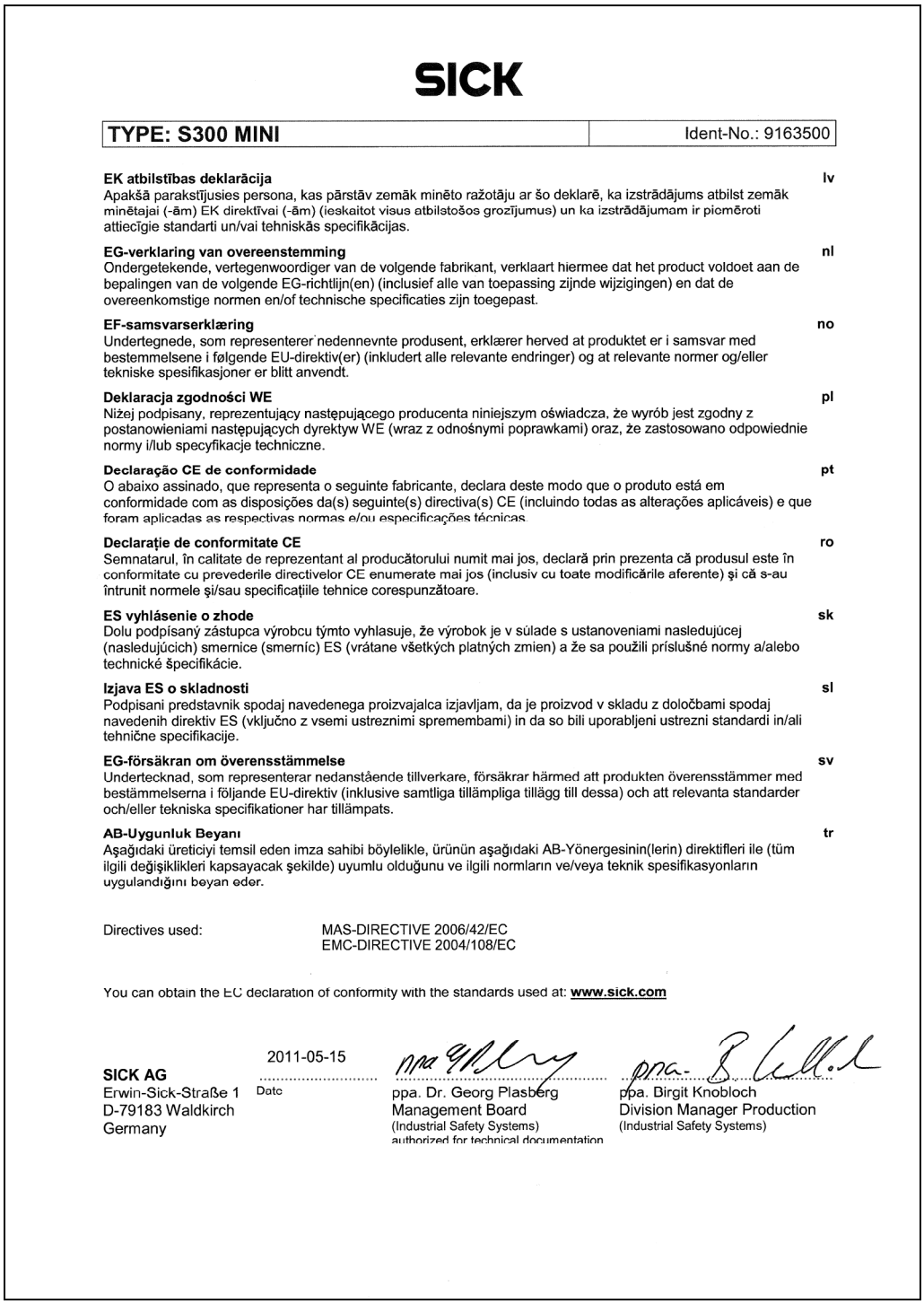
Fig. 85: EC declaration of conformity (page 2)



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TYPE: S300 MINI	Ident-No.: 9163500

EK atbilstības deklarācija lv
Apakšā parakstījusies persona, kas pārstāv zemāk minēto ražotāju ar šo deklarē, ka izstrādājums atbilst zemāk minētajai (-ām) EK direktīvai (-ām) (ieskaitot visus atbilstošos grozījumus) un ka izstrādājumam ir piemēroti attiecīgie standarti un/vai tehniskās specifikācijas.

EG-verklaring van overeenstemming nl
Ondergetekende, vertegenwoordiger van de volgende fabrikant, verklaart hiermee dat het product voldoet aan de bepalingen van de volgende EG-richtlijn(en) (inclusief alle van toepassing zijnde wijzigingen) en dat de overeenkomstige normen en/of technische specificaties zijn toegepast.

EF-samsvarserklæring no
Undertegnede, som representerer nedennevnte produsent, erklærer herved at produktet er i samsvar med bestemmelsene i følgende EU-direktiv(er) (inkludert alle relevante endringer) og at relevante normer og/eller tekniske spesifikasjoner er blitt anvendt.

Deklaracja zgodności WE pl
Niżej podpisany, reprezentujący następującego producenta niniejszym oświadcza, że wyrób jest zgodny z postanowieniami następujących dyrektyw WE (wraz z odnośnymi poprawkami) oraz, że zastosowano odpowiednie normy i/lub specyfikacje techniczne.

Declaração CE de conformidade pt
O abaixo assinado, que representa o seguinte fabricante, declara deste modo que o produto está em conformidade com as disposições da(s) seguinte(s) directiva(s) CE (incluindo todas as alterações aplicáveis) e que foram aplicadas as respectivas normas e/ou especificações técnicas.

Declarație de conformitate CE ro
Semnatarul, în calitate de reprezentant al producătorului numit mai jos, declară prin prezenta că produsul este în conformitate cu prevederile directivelor CE enumerate mai jos (inclusiv cu toate modificările aferente) şi că s-au întrunit normele şi/sau specificaţiile tehnice corespunzătoare.

ES vyhlásenie o zhode sk
Dolu podpísaný zástupca výrobcu týmto vyhlasuje, že výrobok je v súlade s ustanoveniami nasledujúcej (nasledujúcich) smernice (smerníc) ES (vrátane všetkých platných zmien) a že sa použili príslušné normy a/alebo technické špecifikácie.

Izjava ES o skladnosti sl
Podpisani predstavnik spodaj navedenega proizvajalca izjavljam, da je proizvod v skladu z določbami spodaj navedenih direktiv ES (vključno z vsemi ustreznimi spremembami) in da so bili uporabljeni ustrezni standardi in/ali tehnične specifikacije.

EG-försäkran om överensstämmelse sv
Undertecknad, som representerar nedanstående tillverkare, försäkrar härmed att produkten överensstämmer med bestämmelserna i följande EU-direktiv (inklusive samtliga tillämpliga tillägg till dessa) och att relevanta standarder och/eller tekniska specifikationer har tillämpats.

AB-Uygunluk Beyanı tr
Aşağıdaki üreticiyi temsil eden imza sahibi böylelikle, ürünün aşağıdaki AB-Yönergesinin(lerin) direktifleri ile (tüm ilgili değişiklikleri kapsayacak şekilde) uyumlu olduğunu ve ilgili normların ve/veya teknik spesifikasyonların uygulandığını beyan eder.

Directives used: MAS-DIRECTIVE 2006/42/EC
EMC-DIRECTIVE 2004/108/EC

You can obtain the EC declaration of conformity with the standards used at: **www.sick.com**

2011-05-15
Date

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14.2 Checklist for the manufacturer

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Checklist for the manufacturer/installer for the installation of electro-sensitive protective equipment (ESPE)

Details about the points listed below must be present at least during initial commissioning – they are, however, dependent on the respective application, the specifications of which are to be controlled by the manufacturer/installer.

This checklist should be retained and kept with the machine documentation to serve as reference during recurring tests.

1.	Have the safety rules and regulations been observed in compliance with the directives/standards applicable to the machine?	Yes ☐ No ☐
2.	Are the applied directives and standards listed in the declaration of conformity?	Yes ☐ No ☐
3.	Does the protective device fulfil the required PL/SILCL and PFHd according to EN ISO 13 849-1/EN 62 061 and the type according to EN 61 496-1?	Yes ☐ No ☐
4.	Is the access to the hazardous area/hazardous point only possible through the protective field of the ESPE?	Yes ☐ No ☐
5.	Have measures been taken to prevent and monitor unauthorized presence in the hazardous area when hazardous area/hazardous point protection (mechanical protection), and have these been secured against removal?	Yes ☐ No ☐
6.	Are additional mechanical protective measures fitted and secured against manipulation which prevent reaching under, over or around the ESPE?	Yes ☐ No ☐
7.	Has the maximum stopping and/or stopping/run-down time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)?	Yes ☐ No ☐
8.	Has the ESPE been mounted such that the required minimum distance from the nearest hazardous point has been achieved?	Yes ☐ No ☐
9.	Are the ESPE devices properly mounted and secured against manipulation after adjustment?	Yes ☐ No ☐
10.	Are the required protective measures against electric shock in effect (protection class)?	Yes ☐ No ☐
11.	Is the control switch for resetting the protective device (ESPE) or restarting the machine present and correctly installed?	Yes ☐ No ☐
12.	Are the outputs of the ESPE (OSSDs, AS-Interface Safety at Work) integrated in compliance with the required PL/SILCL according to EN ISO 13 849-1/EN 62 061 and does the integration comply with the circuit diagrams?	Yes ☐ No ☐
13.	Has the protective function been checked in compliance with the test notes of this documentation?	Yes ☐ No ☐
14.	Are the given protective functions effective at every setting of the operating mode selector switch?	Yes ☐ No ☐
15.	Are the switching elements activated by the ESPE, e.g. contactors, valves, monitored?	Yes ☐ No ☐
16.	Is the ESPE effective over the entire period of the dangerous state?	Yes ☐ No ☐
17.	Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device?	Yes ☐ No ☐
18.	Has the information label for the daily check been attached so that it is easily visible for the operator?	Yes ☐ No ☐

This checklist does not replace the initial commissioning, nor the regular inspection by qualified safety personnel.

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14.3 Glossary

AOPDDR Active opto-electronic protective device responsive to diffuse reflection (e.g. S300 Mini, see also CLC/TS 61496-3)

EFI Enhanced function interface = safe SICK device communication

External device monitoring (EDM) A device that electronically monitors the relay or contactor operated by the protective device prior to each new start.

Field set Protective fields and warning fields form the so-called field set.

Host/guest To unambiguously identify a S300 Mini in a system, its address must be set to host or guest. In a safety system that comprises several devices, all devices involved can be unambiguously identified by means of the address and information distributed and retrieved using bit assignment.

Incremental encoder A component that produces electrical pulses in proportion to a movement. For these pulses, various physical parameters can be derived, e.g. velocity, direction of travel, etc.

Monitoring case A field set is allocated to a monitoring case. Monitoring case switching is performed using the control inputs. In this way the S300 Mini Remote can be adapted to the operating mode of the machine or system that it monitors.

Optics cover Plastic part with window for light output. The optics cover is available as a spare part.

OSSD (Output signal switching device) The OSSD output is the switching output on the S300 Mini Standard This is a semiconductor output and is periodically tested for correct function. The S300 Mini Standard has two OSSD outputs that operate in parallel; for safety reasons these must be evaluated using two channels.

Protective field The protective field secures the hazardous area on a machine or vehicle. As soon as the safety laser scanner detects an object in the protective field, it switches the OSSDs to the OFF state and thus initiates the shutdown of the machine or stop of the vehicle.

Remission Reflection of luminance. A measure of the remission is the level of remission defined as the ratio of the luminance reflected from a surface in the measuring direction and the luminance of a completely matt white surface (white standard).

Resolution/ object resolution The minimum size of an object that is acquired by the protective device and is guaranteed by the manufacturer.

Restart interlock The restart interlock is a protective device. In certain situations it prevents the machine from automatically restarting. This applies, e.g., after the scanner function has triggered during a dangerous machine state, after a change to the operating mode or the method of activation of the machine, or after the change to the start control device on the machine.

Safe state in case of an error If the internal error detection detects an error that prevents the correct operation of the safety component, the SICK safety component adopts a defined, safe state. The safety component remains in this state until the error or the cause of the error has been rectified.

Error cases in which the safety component adopts a safe state include:
- safety-related internal errors,
- invalid input signal conditions,
- supply voltage loss,
- loss of the assured detection capability.

Universal I/O The S300 Mini has two universal I/O connections. These two connections can be configured as inputs (e.g. for stand-by, EDM or reset) or as outputs (e.g. for device error, contamination or second warning field).

Warning field The warning field is a field with a radius of up to 8 m (see section 12.1 “Characteristics” on page 105). Using this field larger areas can be controlled and simple switching functions (e.g. warning functions) triggered. The warning field is not allowed to be used for tasks related to personnel protection.

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